Dissertation

Submitted to The Dr. M.G.R. Medical University, Tamilnadu, in partial fulfillment of the requirements for M.Ch. Branch-IV (Genitourinary surgery) examination to be held in August 2015

URODYNAMIC APPRAISAL OF URO-SELECTIVE ALPHA BLOCKERS-TAMSULOSIN IN THE TREATMENT OF PRIMARY BLADDER NECK OBSTRUCTION IN MEN

DEPARTMENT OF UROLOGY

CHRISTIAN MEDICAL COLLEGE

VELLORE- 632004

BONAFIDE CERTIFICATE

This is to certify that the work presented in this dissertation titled "**URODYNAMIC APPRAISAL OF URO-SELECTIVE ALPHA BLOCKERS - TAMSULOSIN IN THE TREATMENT OF PRIMARY BLADDER NECK OBSTRUCTION IN MEN**" done towards fulfillment of the requirements of the Tamil Nadu Dr. M.G.R. Medical University, Chennai for the Mch. (Branch– IV) (Urology) exams to be conducted in August 2015, is a bonafide work of the candidate Dr. Manoj Kumar Sudrania, Senior Post graduate student in the Department of Urology, Christian Medical College, Vellore under my guidance and supervision. This dissertation has not been submitted, fully or in part to any other board or University.

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I, **Dr. Manoj Kumar Sudrania,** senior post graduate student in the Department of Urology, Christian Medical College, Vellore hereby declare that the contents of the thesis have not been submitted earlier in candidature for any degree.

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CONTENTS

INTRODUCTION

Primary bladder neck obstruction (PBNO) has been identified as one of the causes of lower urinary tract dysfunction in young men. These men are initially misdiagnosed as having chronic prostatitis, neurogenic bladder dysfunction or psychiatric disorder. PBNO is a non neurogenic voiding disorder in which bladder neck does not open well during voiding phase causing obstruction to flow in absence of other anatomic obstruction. Obstruction can cause severe lower urinary tract symptoms sometimes leading to renal failure. It was first described by Marion [1] as hypertrophy of smooth muscles of bladder neck in 1933. It was called Marion's disease after him. The exact pathophysiology of PBNO is not well understood and different hypothesis has been postulated. Recently the increase in neuropeptide Y immunoreactive nerves has been described as the cause of PBNO [2.]

Nitti et al [3] have classified primary bladder neck obstruction into three types. Type one includes high pressure low flow with persistent narrowing at bladder neck, type two includes normal pressure and low flow with persistent narrowing at bladder neck and type three involves delayed opening of bladder neck of more than 10 seconds.
Simple test like uroflowmetry are good screening test in patients with lower urinary tract symptoms (LUTS), however they are not diagnostic. Video urodynamic study has become the gold standard diagnostic tool for PBNO. Blaivas and Norlen described the diagnostic criteria for primary vesical neck obstruction based on videourodynamic evaluation, which include high voiding detrusor pressure, low uroflow, and narrowing at the vesical neck with absence of the sphincteric actvity as seen on electromyography[4]

The treatment options are observation with follow ups, pharmacological therapy with alpha blockers or surgical treatment with bladder neck incision. Most studies with respect to efficacy of pharmacological treatment have been small and non randomized. Types and dosage of drugs used in these trials have not been consistent. Although some studies have suggested the possible beneficial role of alpha-blocking agents, Kaplan et al reported that none of 24 patients with primary bladder neck obstruction treated with alpha-blocking agents experienced significant symptomatic improvement.[5] Mishra [6] and Trockmann [7] demonstrated beneficial effect of alpha blockers while Norlen [4] did not show any benefit. Nitti et al[3], Yang etal[8] and recently Bing Li et al [87] showed 58%, 54% and 66.7 % success rates of alpha blocker respectively, but none were proved urodynamically. The few prospective studies available did not include post treatment urodynamic study, hence lacking the objective proof of the efficacy of alpha blockers. Despite the lack of objective proof of the efficacy of the alpha blocker for primary bladder neck obstruction, these drugs are widely prescribed for this condition. Apart from side-effects there are financial implications of such practice. Patients have to spend 7- 10 rupees per day for a treatment whose efficacy, duration and durability is questionable. There are very few studies in literature which has attempted to study the efficacy of alpha blocker prospectively and objectively. Hence we planned to objectively study the efficacy of alpha-blockers in patients with primary bladder neck obstruction.

REVIEW OF LITERATURE

"**As man draws near the common goal can anything be sadder than he who, master of his soul is servant to his bladder**" Anon

Lower urinary tract symptoms are the group of symptoms which are the normal deviations from the normal storage and voiding functions of the bladder. Prostatism was the term used by all for the urinary symptoms which was replaced by LUTS in 1994 by Abrams [9] representing that benign prostatic enlargement is not the sole cause of storage and voiding symptoms. LUTS is quite common and can be seen in all age groups and in both the sexes. LUTS is not pathognomonic for bladder outlet obstruction. Various etiologies include benign prostatic hyperplasia, detrusor overactivity,under active bladder, ureteral calculus, urethral calculus, foreign bodies, prostatitis, bladder tumours, primary bladder neck obstruction, urinary tract infection, neurogenic bladder dysfunction and idiopathic. Once regarded as uncommon in young people it is not that uncommon as seen in various studies. After excluding other causes as UTI, urethral calculus, stricture etc voiding dysfunction remains a common cause.

Lower urinary tract symptoms (LUTS): Subjective indicator of the disease as perceived by the patients. LUTS can be classified as: storage, voiding, and post micturition symptoms.

1) *Bladder storage (irritative) symptoms* are experienced during the storage phase of the bladder and include:

- increased daytime frequency- voids very often

- nocturia- Have to wake up at least once after sleep to pass urine
- Urgency-Sudden compelling desire to void which is difficult to defer
- urinary incontinence– involuntary leakage of urine

2) *Voiding (obstructive) urinary symptoms* are experienced during the voiding phase

- slow urinary stream- decrease in urine flow as compared to previous performance
- splitting or spraying of the urinary stream
- intermittent urinary stream- flow stops and starts in one or more occasions
- hesitancy-difficulty in starting micturation which delays the onset of micturation once he is ready to void
- straining to void- effort required to initiate, maintain or increase the flow
- terminal dribbling – final part of micturation when flow is prolonged and dribble

3*)* Post micturation symptoms- occurs after act of voiding is over

- feeling of incomplete emptying of bladder
- Post micturition dribbling- dribbling of urine after act of micturition is over. In men it is usually after leaving the toilet and in female after getting up from toilet.

PBNO once considered to be a rare diagnosis is not that uncommon. Turner Warwick described it as poorly understood non neurogenic bladder condition present only in

young adults or in middle aged people [10]. Now it is known that it can be present in pediatric age group too. Very frequently these patients present with LUTS including scrotal, perineal or testicular pain. The clinical diagnosis is usually inaccurate and non specific which includes chronic pelvic pain syndrome, prostatitis, prostatodynia before a definite diagnosis of PBNO is made. They are often treated empirically with antibiotics, anticholinergic, alpha blockers till the final diagnosis is made. It is a progressive disease and if not treated timely, it can lead to chronic renal failure. Nitti et al have classified primary bladder neck obstruction into three types. Type one includes high pressure low flow with persistent narrowing at bladder neck, type two includes normal pressure and low void with narrowing at bladder neck and type three involves normal pressure with normal flow but delay in opening of bladder neck. Axelrod and Blaivas defined primary bladder neck obstruction in women as sustained detrusor pressure of at least 20 cm of water and maximum flow less than 12ml/second with bladder neck not opening well. [11]

Prevalence of LUTS

Study done to assess presence of LUTS and Vitamin D deficiency by United States National health and Nutritional Examination survey in 2005-2006 in young males above 20 years found 65 % of males having at least one symptom of LUTS between age group 35-44 years of age [12]. EPIC survey was done in 5 countries in individuals more than 18 years and included both males and females. This study found the similar prevalence of LUTS in both males and females of 66.6 % and 62.5 % respectively and nocturia as the most common storage symptoms [13]. BACH was a population based random survey studying the prevalence of LUTS in males and female between age

group of 33-70 years. They also found the similar prevalence in both the groups [14]. Korean EPIC study found a prevalence of LUTS in general population in males younger than 40 years to be 37 %. They assessed the prevalence of bladder over activity, urinary incontinence and LUTS [15]. One of the hospital based survey in Greece found the prevalence of 59 % in patients in age group 18- 40 years with at least 1 point in International prostatic symptom score.[16]

PBNO is present both in males and females and pediatric age group but more commonly in men. Kaplan et al [5] in his retrospective study of 130 patients who had Urodynamic study done for evaluation of LUTS found an incidence of 54%. Similarly Nitti et al [3, 17] found an incidence of 47 % in male and 4.6 % in female patients with LUTS. Kuo [18] reported 8.7% incidence of PBNO in women with LUTS on pressure flow study.

Etiology

There is no definitive etiology for PBNO. Various hypothesis and explanations has been given by different authors since it was first described by Marion as the hypertrophy of the smooth muscles of the bladder neck in 1933. It was called Marion's disease after him. Lead better [19] explained that smooth muscle hypertrophy and fibrosis at bladder neck was because of excessive amount of mesenchymal tissue. Turner Warwick hypothesized that the abnormal arrangement of detrusor muscles in trigone and bladder neck caused PBNO [20].

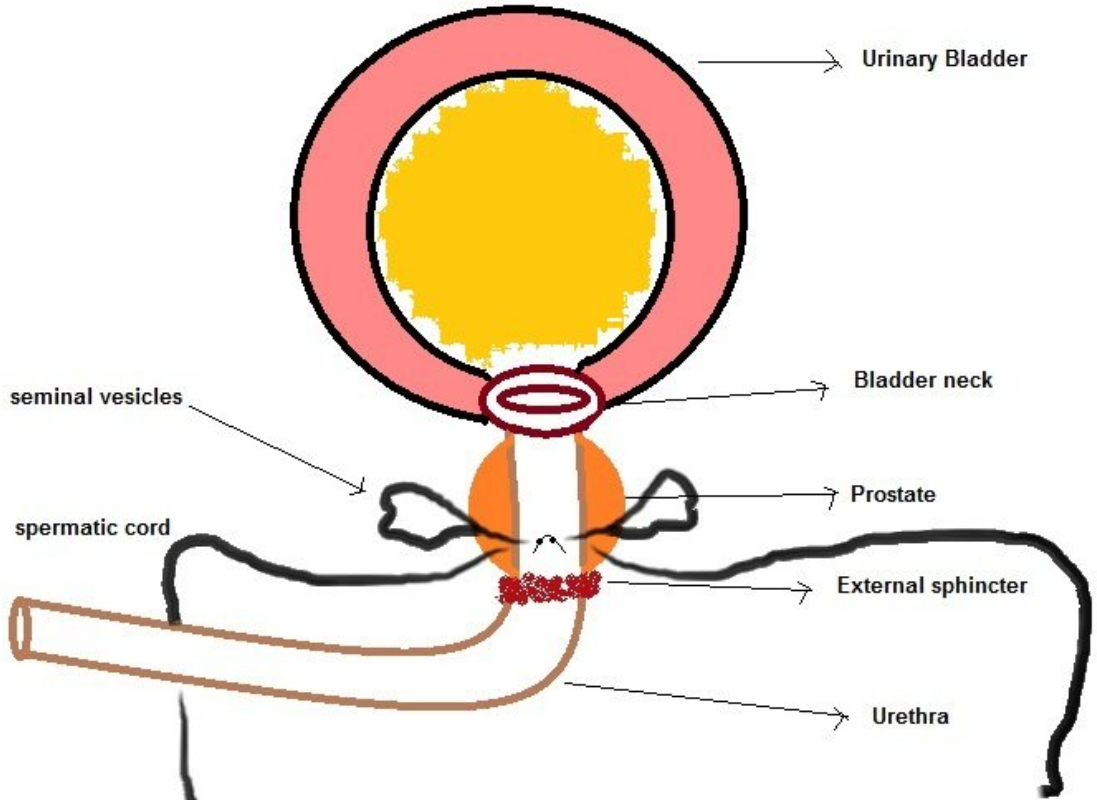
Striated urethral sphincter is the first to relax during voiding followed by bladder neck opens and voiding results. Yalla et al found that 48 % men has striated urethral muscles extended till the bladder neck and this can lead to dysfunctional voiding [21]

The bladder neck is supplied by sympathetic, parasympathetic and also by other neuropeptides like vasoactive intestinal peptide ,calcitonin gene related peptide, neuropeptide Y and substance P. Sympathetic nerves are predominantly in inner muscle and acts as sphincter in men and its contraction prevents retrograde ejaculation The parasympathetic nerves supplies the outer muscle layer. Neuropeptide had been mapped by Crowe et al and supports the sympathetic nervous dysfunction for the cause of bladder neck obstruction [22]. Awad et al hypothesized that there is increase in sympathetic activity in the proximal urethra and can cause PBNO [23]

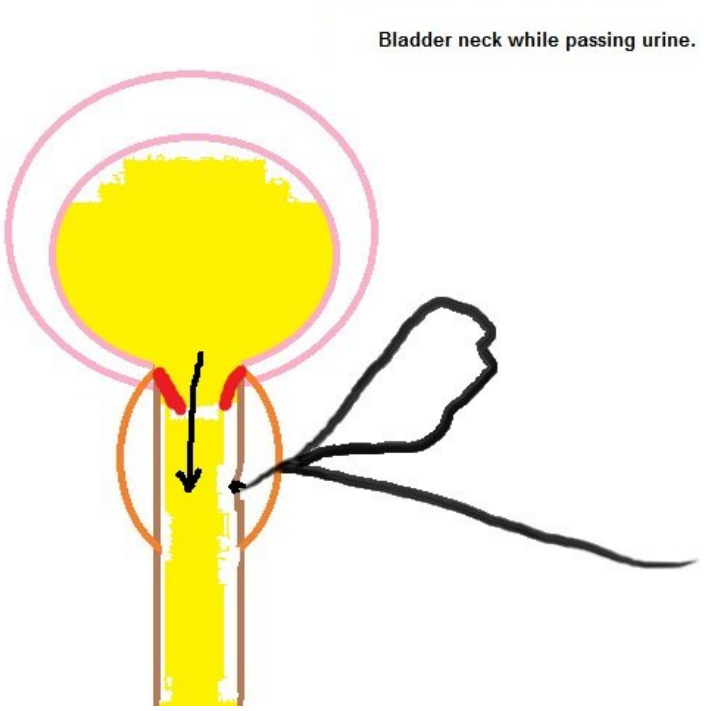
Clinical symptoms

Patients have LUTS for years before they seek medical attention for the same. Delayed presentation may be because of mild nature of the symptoms or they are misdiagnosed before a proper diagnosis is made. Patients present with voiding and storage LUTS and sometime with urinary retention. Study by Huckabay reported the incidence of 15 % presenting as retention as the initial presentation [24]. Pelvic pain can also be presenting feature in almost half of patients. The exact prevalence of renal failure in PBNO is unknown but this association has been recognized. High pressure chronic retention is a dangerous form of retention resulting in high bladder pressure causing upper tract changes and renal failure [25.] Bladder outlet obstruction also causes detrusor hypertrophy initially which later causes malfunction leading to poor compliance, bladder

instability and high urine residue [26]. In long standing cases it results in decompensate state and cannot generate much pressure to empty the bladder resulting in stasis of urine. This high residual volume causes recurrent UTI further deteriorating the renal function.



Picture 1: Anatomy of Lower urinary with closed bladder neck closed at resting state



Picture 2 :Opening of bladder neck during micturition

Assessment

The aim of assessment is to diagnose the disease, plan the treatment, prognosticate and for follow up.

The first and foremost is the good history to find out the exact cause of the symptoms and also the co morbidities which can interfere with the treatment or may be cause of the symptoms. It is important to know the current medication, neurological and psychiatric illness.

Symptom score questionnaire

The international prostatic symptom score consists of seven symptom questions and one quality of life .Each question allows patients to choose one answer out of 6 as per

the severity .The answers are from 0-5 making maximum of 35. It has been graded into mild with score 0-7, moderate 8-19 and severe between 20-35.

Questions pertain to patients symptoms as

1 Incomplete emptying

2 Frequency

3 Intermittency

4 Urgency

5 Weak Streams

6 Straining

7 Nocturia

8th question refers to quality of life

There are other symptoms scoring system which tries the quantify the severity of symptoms like The International Consultation on Incontinence Questionnaire (ICIQ-MLUTS)

Renal function tests

Primary bladder neck obstruction is the progressive disease. So it is necessary to check serum creatinine level in all young LUTS patients to rule out renal failure. Raised serum creatinine, hydronephrosis and urinary retention are more prevalent in patients with LUTS

Imaging

Retrograde urethrography or cystoscopy is done to rule out urethral stricture. Routine imaging of the upper tracts is not recommended in patients with LUTS. It is

recommended in patients with raised serum creatinine, high post void residual volume, history of gross or microscopic haematuria or prior history of calculus disease.

The voiding diary/ Frequency Volume chart

It is for measuring the frequency, severity and impact of LUTS. The patient is asked to record micturitions and symptoms for a period of days .It gives us the daytime frequency, nocturia, functional bladder capacity, total urine production in 24 hrs and total fluid intake in a day.

Advantage

- It asses the severity of symptoms
- It adds objectivity to history
- It is useful in a bladder retraining programme

BLADDER DIARY

Dept. of Urology

Christian Medical College, Vellore

Date.....

Name.....

INSTRUCTIONS FOR BLADDER DIARY

This diary is an important tool and helps us to give you the correct treatment. Maintain this for at least one day, 24 hours (e.g. 6 AM to 6 AM)

Column 1: Whenever you drink any liquids – coffee, water, juice, milk or any other liquids, measure using a measuring jar and note down in the first column.

Column 2: Use another measuring jar to measure the urine every time you pass and note immediately in the sheet the tome and the quantity of urine. This should b e done in the day and the night, every time you pass urine. If you have urgent desire to pas urine, please note down,. Urine can be discarded after measuring.

Column 3: Please fill only if you pass urine on your clothes without control. If you have no urine leakage, ignore this column and leave it blank. if you have urine leakage, note down the time, what you were doing at that time and whether you leaked a small or large quantity.

Column 1 Fluid intake			**Column 2 Urine output**				**Column 3 Any urine leakage**		
Time	Volume		Time	Volume	Urgency		Time	Amount	Activity

Urodynamic study

Urodynamic is the functional study of bladder filling, storage and voiding. It includes number of tests which individually or in combination gives the functional status of the bladder, urethra and pelvic floor muscles. The term urodynamic was coined by David M Davis in 1953 to study the storage and voiding phase of bladder. Hinman and Miller in 1954 started the use of imaging during urodynamic study [27]. Standard urodynamic includes the filling cystometrogram and pressure flow study. Video urodynamic includes the fluoroscopic imaging during the study besides the multichannel UDS. This increases the cost and radiation to patients hence video UDS should be done in selected patients.The video urodynamic helps to diagnose vesicoureteral reflux, anatomic variations of the bladder, voiding dynamics in women with a cystocele or pelvic organ prolapsed, bladder neck function, detrusor–external sphincter dyssynergia (DESD) Dysfunctional voiding/pelvic floor dysfunction, urinary fistulas urinary incontinence, neurogenic bladder.

Role of UDS: UDS is the not the first line of investigation. It is the adjunct to the history, physical examination and simple tests. Clinician should have a question before asking for the UDS.

Hosker etal has summarized the role of UDS in clinical practice [28]

1. To find out the factors leading to lower urinary tract dysfunction
2. To find out information of other aspects of lower urinary tract dysfunction.
3. To predict consequences on upper tracts.

4. To predict outcome including side effects of the treatment given.

5. To find out the effect of an intervention

6. To find out the reasons for failure of previous treatment

UDS should be customized according to the situation and questioned to be answered to get the best out of the study. It is not the natural setting where this study is done. It is important to interpret urodynamic results with the patient's symptoms, examination findings, frequency volume chart and uroflow and post void residue whenever possible. The risk of the investigation should be kept in mind before ordering the test. There is small chances of urinary tract infection, urethral trauma, bleeding.

Components of UDS:

Urodynamics consists of different components which can be used singly or in groups to get the information about storage and voiding functions.

1. Post void residue (PVR): It is the amount of urine left behind in bladder after voiding. This can be measured either by a urethral catheter or by ultrasound. High PVR points towards the abnormality of the voiding phase. It cannot distinguish between underactive bladder or bladder outlet obstruction or both. It has high test retest variability so the exact threshold for starting of treatment is not recommended.

2. Uroflowmetry: It is the noninvasive test to measure the urine flow rate over time. It is outcome of interactions between the contraction of detrusor and various outlet forces. It is a useful screening test; but is not diagnostic. It gives quantitative and objective data which helps in diagnosing the etiology in LUTS There are some pre-requisites to do the

uroflowmetry. It should be done in privacy and the patient should have normal desire to void .Flow rates are most predictable in range of 200ml to 400 ml and at least 150 ml of voided volume. The normal flow curve is smooth bell shaped curve and maximum flow is normally reached within 3 s to 10 s from the onset of micturition

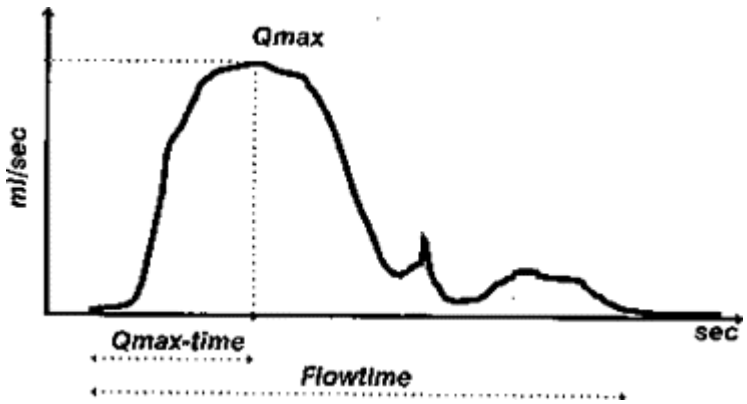


Figure 1: Normal uroflow curve

Any deviation from normal curve represents some abnormality but cannot exactly tell the etiology. Normal detrusor contractility and low intraurethral pressure results in normal flow[29]. When the detrusor contractility decreases it can result in smooth curve lower amplitude. When there is increase in urethral opening pressure like in benign prostatic hyperplasia causes a curve called compressive curve which is flattened asymmetric curve with slow decline. Similarly a constrictive pattern is seen in urethral stricture which is plateau like curve.

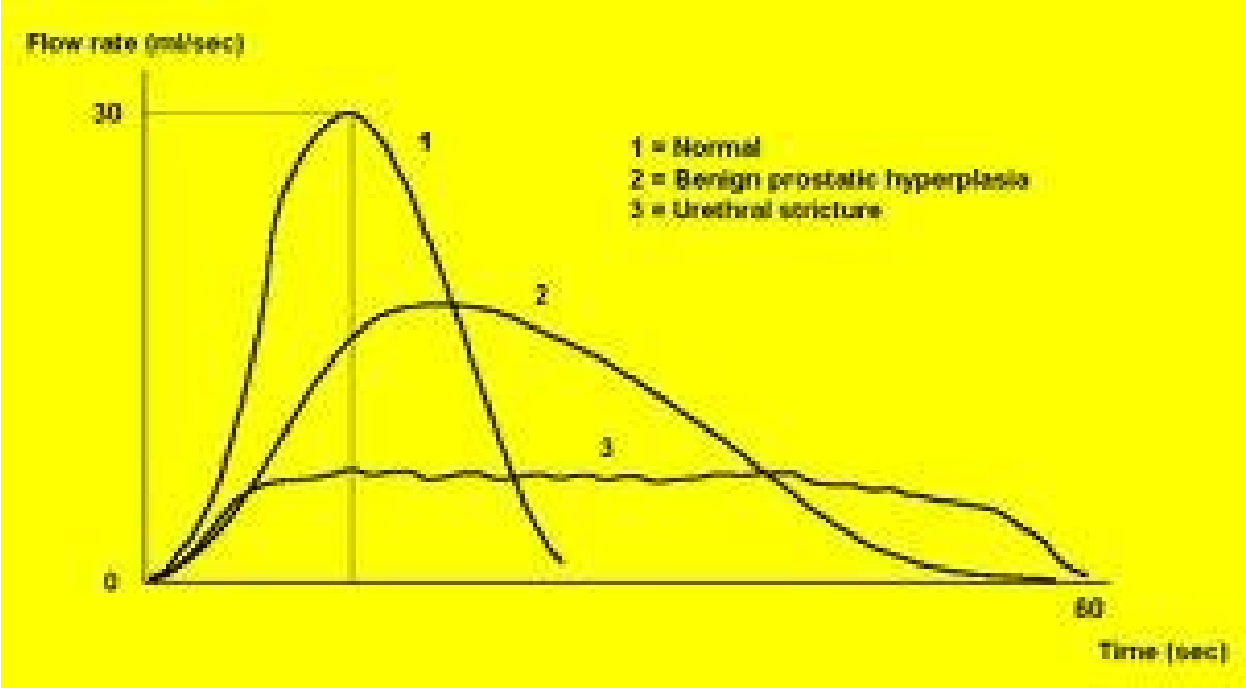
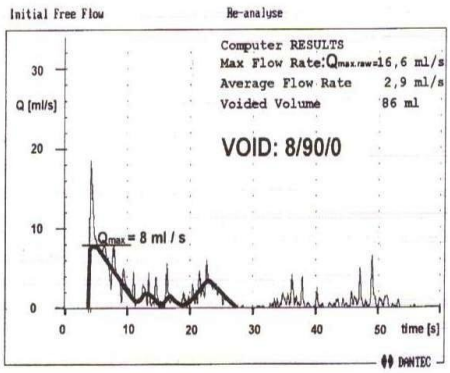
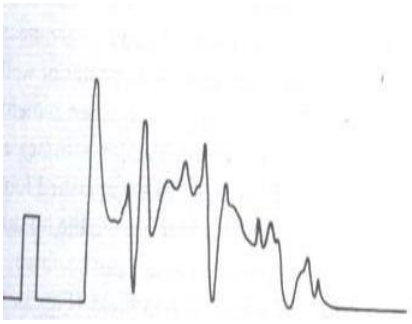


Figure 2: Different types of uroflow curves

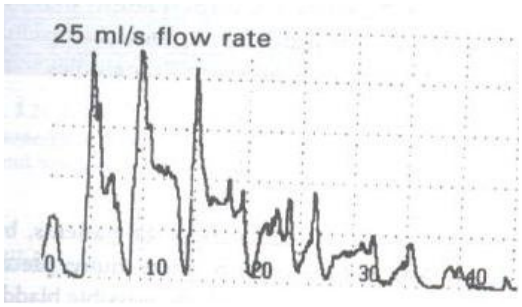
There are number of factors which affect them. Maximum flow rates depend on the voided volume .Both small volume (< 150 ml) and large voided volumes (500ml) can cause low flow rates. Patients with outlet obstruction have low maximum and reduced average flow. The maximum flow rate > 15 ml/s have 30 % chances of bladder outlet obstructions where as maximum flow rate between 10-14 ml/s and <10 ml /s have 67% and 90 % chances of obstruction respectively. Various artifacts associated with the uroflowmery has to kept in mind before interpreting it



Kick phenomenon



Wag artifacts



Squeezing artifacts

Figure 3: Artifacts seen during uroflowmetry

To diagnose a specific pathology all the components that affect the flow rates have to be measured simultaneously i.e. pressure flow studies measuring abdominal and vesical pressure components simultaneously.

3. Filling Cystometry: It the method of measuring pressure volume relationship of bladder during the filling phase. It starts from the onset of filling and ends when patient is instructed to void. Detrusor pressure is calculated by subtracting intravesical pressure from abdominal pressure Intravesical pressure can be measured by a per urethral

catheter or a suprapubic catheter. Intra-abdominal pressure is measured separately with the help of a rectal or vaginal balloon.

4. Electromyography (EMG): is the study of membrane potentials of the muscle membrane. It is used to study the co-ordination between detrusor function and external urethral sphincter. EMG electrodes can be surface electrodes or needle electrodes. Surface electrodes are placed in the perianal area

5. Urethral pressure profile (UPP): is the study of urethral pressure along the length of the urethra and depicted as a graph. Urethral pressure is defined as pressure needed to just open the urethra. It is obtained by withdrawing the pressure sensor catheter along the length of urethra.

6. Pressure flow study (PFS): The relationship between the bladder pressures and flow rate is measured during the micturiting phase It starts from the time when patient is given permission to void till he feels he has voided completely It differentiates between bladder outlet obstruction and underactive bladder.

7. Videourodynamics (VUDS): involves simultaneous measurement of pressure flow studies and imaging of the lower urinary tract. It gives information for both functional and anatomical factors for bladder dysfunction. It localizes the level of obstruction, sphincter function, detection of reflux in filling and voiding phase of the study. VUDS can confirm bladder neck dysfunction and striated sphincter dys-synergia as picked up on EMG

Limitations: Multichannel or videourodynamics are invasive and costly. They are done in an un-natural environment and may not reproduce the day to day voiding pattern during

the study. As the filling rate is not physiological, poor bladder compliance may be recorded. And then there is risk of radiation exposure. The setup of VUDS is expensive and expertise of conducting a VUDS is not available at all places. Some of these limitations can be overcome by doing ambulatory urodynamics.

Ambulatory urodynamics (AUM): is the functional testing of lower urinary tracts using natural filling and reproducing individuals day to day activities.

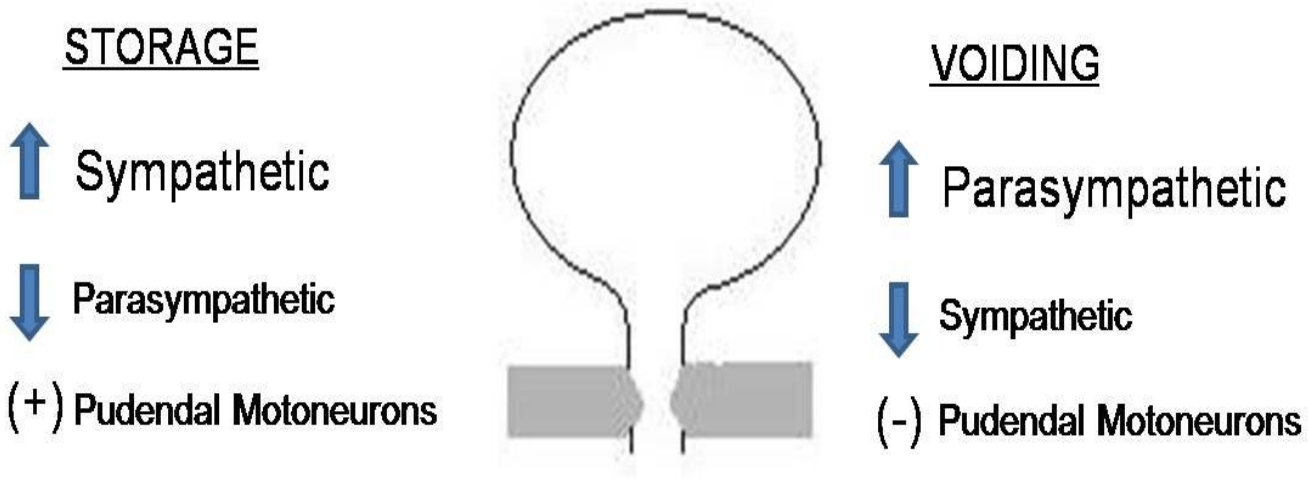


Fig 4: Neural activity during voiding and storage phases

To study patients with LUTS, it is generally accepted that urodynamic studies, including pressure-flow analysis, are the reference standard. Several investigators have reviewed the role of alpha-blocking agents in the treatment of BPH. Most studies evaluating medical therapy for LUTS confined the analyses to symptom scores, free uroflowmetry,

measurement of residual volume, and assessment of side effects. Most of the existing studies have demonstrated that alpha-blockers are clinically effective, producing an increase in urinary flow and a significant relief of symptoms. Few of the above-mentioned reviewers included the urodynamic effects of alpha-blocking agents in their studies

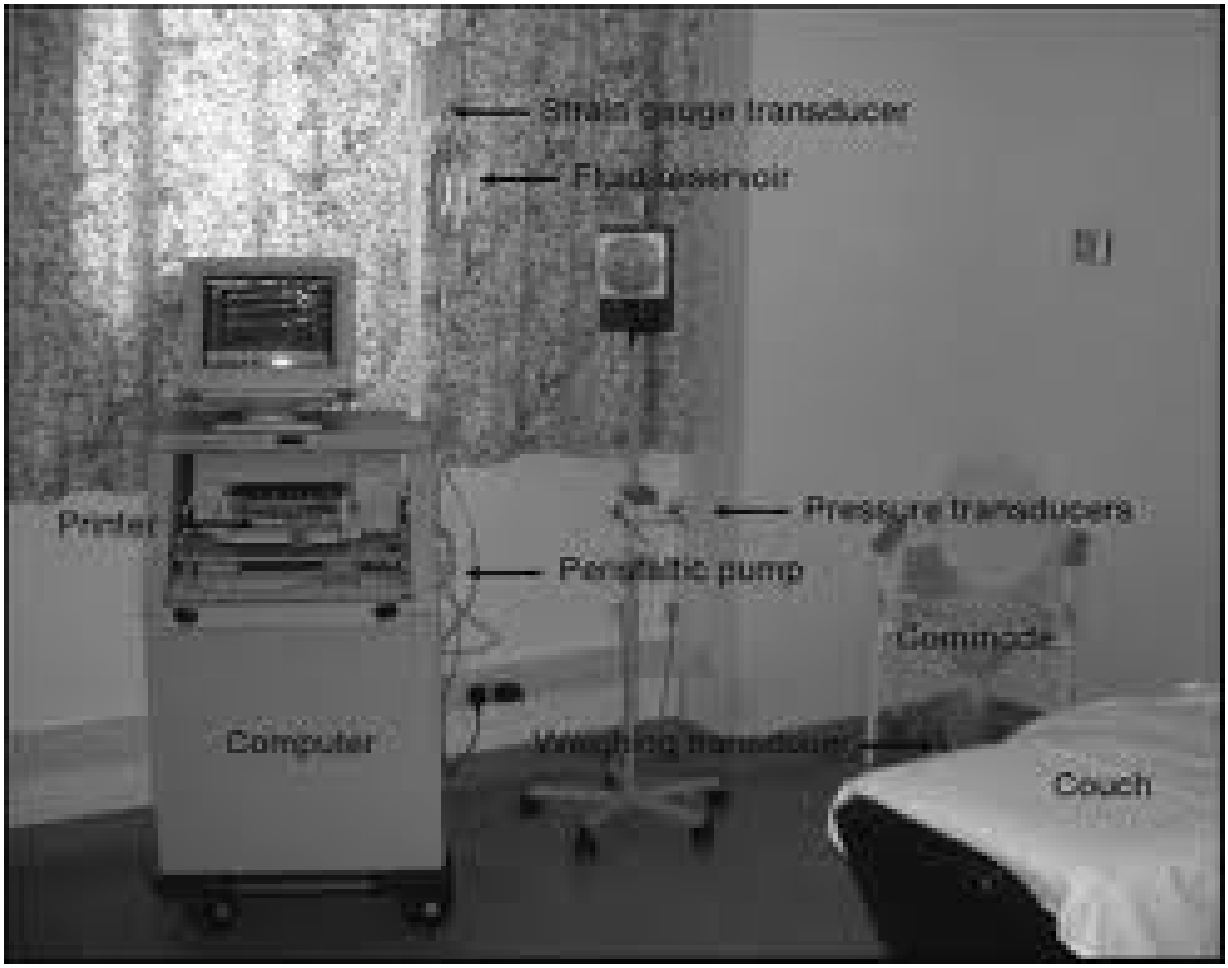


Figure 5: Urodynamic Suite

Videourodynamic in PBNO

The diagnosis of PBNO is made on videourodynamics (VUDS) when 5 criteria have been met- prolongation of opening time (time between onset of detrusor contraction and

the start of flow); delayed or incomplete opening (lack of funneling) of the bladder neck during voiding; depressed uroflow parameters despite an adequate or increased detrusor contraction; silent pelvic floor or external urethral sphincter electromyogram (EMG) during voiding; and no associated prostatic enlargement, concomitant urethral obstruction, previous bladder neck surgery or bladder neck hypertrophy from a previous obstructive process ie valve, stricture, dysfunctional voiding. Initially it was suggested to diagnose PBNO based on UDS and voiding cystourethrogram [30] but now VDUS is considered the gold standard for diagnosis of PBNO[31.] Yang Wang in 2003 recommended video urodynamic in young patients with LUTS[32] Turner-Warwick et al advocated the use of urodynamics and voiding cystourethrography to diagnose bladder neck dysfunction in males 50 years old or younger with lower urinary tract symptoms[30] Similarly, Norlen and Blaivas used videourodynamics to diagnose vesical neck obstruction in 23 young and middle-aged men with referring diagnoses of prostatitis, neurogenic bladder and psychogenic voiding dysfunction[4] Kaplan et al performed a retrospective review of 34 males diagnosed with chronic refractory prostatitis[5.] Using videourodynamics 31 patients had urodynamic evidence of bladder outlet obstruction localized fluoroscopically to the vesical neck. Blaivas and Norlen described the diagnostic criteria for primary vesical neck obstruction based on videourodynamic evaluation, which include high voiding detrusor pressure, low uroflow, and narrowing at the vesical neck with and silence of the sphincter as seen on electromyography [4] Videourodynamics is extremely useful in providing an accurate diagnosis, as urodynamic parameters can be measured and the bladder outlet visualized. It should be an integral part of the evaluation for a young man with refractory lower urinary tract

symptoms seeking treatment. Combs[33] et al described a noninvasive method to diagnose PBNO using uroflow and EMG to measure pelvic floor EMG lag time. Lag of 6 seconds in pelvic floor relaxation and start of urine correlated with UDS proved PBNO.

The minimal criteria to establish a diagnosis of proximal urethral obstruction should include sustained and high detrusor pressure during voiding; radiographic or manometric evidence of obstruction at the level of the bladder neck; complete relaxation of the external sphincter during electro myography or radiographic study during voiding; a pressure-flow relationship showing obstruction; and no distal obstruction. Gilija et al found that all his patients had high detrusor pressure till the bladder neck opened which had a prolonged time but as soon as the bladder neck opened the detrusor pressure fell abruptly. This shows that there is difficulty in opening the bladder neck but once it is opened it may not require high pressure to complete the voiding[34]

Videourodynamic study is gold standard to diagnose the bladder outlet obstruction .But it is the invasive study. There are various noninvasive techniques studied to diagnose bladder outlet obstruction which includes doppler resistive index, doppler ultrasound urodynamics, and bladder wall thickness.

Bladder wall thickness and bladder weight –bladder wall thickness may increase due to hypertrophy of detrusor muscles in bladder outlet obstruction[35.] Carlo et al studied the correlation between the pressure flow studies and bladder wall thickness. He measured the bladder wall thickness at the lateral or anterior wall by transabdominal ultra at bladder volume of 150ml. 3 readings were done and average value was taken. Good correlation was found between the two. Cut off of 5 mm was taken. When bladder wall

thickness was < 5 mm 63.3 % were un obstructed and if it was > 5 mm the obstruction was found in 87.5 % patients[36]

Doppler resistive indices-In bladder outlet obstruction there is the hypertrophy of the muscles but the flow to bladder does not increase thus there is decrease in effective blood flow. In one of the study, 29 patients with bladder outlet obstruction were evaluated with color Doppler and resistive index was calculated at three places in the bladder and compared with the normal individual [37] .There was definitive difference in resistive index between the 2 groups. Apart from BOO, atherosclerosis, advanced age, detrusor activity can also cause decrease in blood flow. One of the studies showed sensitivity and specificity of 85 and 46 respectively in diagnosing BOO when resistive index was more than 0.7[38]

Near infra red spectroscopy – Pulse oximetry and cerebral oxygenation monitoring utilize near infrared spectroscopy (NIRS) to monitor changes in concentrations of chromophores (oxyhemoglobin and deoxyhemoglobin) [39]. Photons from near infra red spectrum are absorbed by chromophores According to the research, men can be classified into obstructed and non obstructed based on pattern of chromophore concentration slope of change, Qmax, and PVR.[39] Chromophobe concentration changes is influenced by blood flow and oxidative metabolism and affects oxyhaemoglobin [39,40] . Down ward slope of Chromophobe concentration is related with bladder outlet obstruction and vice versa. 80% concordance has been shown with near infra red spectroscopy and urodynamic study in diagnosing bladder outlet obstruction[39]

Measurement with external catheter- pressure can be measured by using modified condom catheter. Pressure transducer is placed at the outer end of the catheter. Comparison has been made between pressure flow studies, Qmax and measurement with external catheter[41, 42] . In one of the study 30 % were found to be obstructed based only on the Qmax rest had combined Qmax and external catheter compared with pressure flow study. If Qmax and external catheter were either obstructed or equivocal, they had 90% concordance of diagnosis BOO on pressure flow study but only 67 % concordance if Qmax and external catheter were non obstructed[43]. This has the disadvantage of bad fitting condoms, uncomfortable condoms, leakage from condoms

Measurement using penile compression It's like measuring the blood pressure in the arm. A cuff is tied around the penis and cuff inflated to give the cuff pressure equivalent to isovolumetric bladder pressure. The cuff is released to allow voiding and measure the pressure. A cuff is inflated to 250 cm H2O and the patient is instructed to void against the occluded urethra. When the bladder contracts, urine column between the bladder and the cuff and allows isovolumetric pressure to be measured. Once the column is formed the cuff is released slowly until the urine flow starts .When the flow is 1 ml/s the cuff is deflated completely[44]

Several non invasive tests have been studied for diagnosing BOO but video urodynamic study remains the gold standard for diagnosing PBNO.

Studies have demonstrated the poor correlation between patient reported LUTS and BOO on urodynamics. The International Continence Society conducted a BPH study evaluating 1271 men When the pressure-flow studies of 933 men were compared to their answers on the ICS male questionnaire, there were no correlations noted on either

the storage or voiding symptoms [45]. Reynard and Abrams were able to demonstrate a weak correlation between symptoms of hesitancy and decreased flow with BOO on urodynamics ($p = 0.04$ and $p = 0.002$, respectively) [46, 47]. When other symptoms such as intermittency, terminal dribbling, and straining were analyzed, no association to BOO was observed in the same cohort of patients [29,49] The severity of symptoms as determined by validated self-administered questionnaires, such as the International Prostate Symptom Score (IPSS) or the American Urological Association symptom index (AUA-SI), is poorly related to BOO [50]. Scores on these questionnaires do not act as a surrogate to diagnose BOO. Patient reported symptoms should guide management to some extent, however because BOO cannot be determined with questionnaires alone, surgical decision making should incorporate some assessment of BOO.

Treatment

Treatment options for patients of primary bladder neck obstruction are watchful waiting, clean intermittent catheterization, behavioural changes , pharmacotherapy and surgery Patients with minimal symptoms and normal upper tracts can be kept on watchful waiting[24]. Alpha blockers have been tried with variable success in these patients. success rate of alpha blockers has varied from 50-70% in various series and number of patients who continue to be on medications at one year vary from 25-80%(44,45,47,48). Transurethral incision of the prostate is the surgical treatment in patients with primary bladder neck obstruction. The patients who don't want medical treatment, failed medical therapy, renal failure secondary to PBNO are the candidates for TUIP .There are various modifications to the standard bladder neck incisions

Conservative treatment [51]

- Educate the patients about his condition
- To reassure the patients that there is no malignancy associated with it
- Regular monitoring
- Life style modification

    -To reduce the fluid intake aimed at reducing the frequency

    -To reduce intake of caffeine and alcohol

    -Urethral milking to avoid post micturition dribble

    -Double voiding

    -Bladder retraining

    -To treat constipation

Transurethral incision of the prostate was first described by Orandi in 1969. It is given at 5 and 7 o' clock position, starting 1 cm distal to the ureteric orifice through the bladder neck till just proximal to verumontanum. Incision is deepened until no ridge is seen at bladder neck and fat is seen between the cut fibers of bladder neck[52]. Some people cut it up to the fibers but not through it to reduce the bleeding. It is not necessary to resect the intervening prostatic tissue between the two incisions in young males. It can be done under spinal or general anesthesia. This is done using 24 Fr resectoscope and Collins knife, Sachs knife, Orandi knife. Post operatively 22 Fr 3 ways catheter is placed and irrigation continued for a day. Catheter is removed after 2-3 days. Its efficacy has been well documented in various studies with respect to improvement in symptoms One of the main problem with the surgery is retrograde ejaculation which can be present in

patients up to 25 %. For decreasing the retrograde ejaculation in young people Orandi modified the procedure by creating shallower incision and limiting it to prostatic tissue only. This can be really distressing in young patients. It can also adversely affect the fertility of the individual. Turner Warwick used single full thickness incision to reduce the rate of retrograde ejaculation. The single incision is given at 5-, 6-, or 7 –o clock positions. The most popular single site incision is at 6-oclock. Studies using single side incision report it to be effective and lack retrograde ejaculation [53.]

No guidelines have been made as where to give incisions in bladder neck especially in female PBNO. Turner Warwick gave a single incision anteriorly to avoid fistula at vaginal vault which can happen after posterior or postero-lateral incisions. Kumar et al [52] and Delaere et al [54] also used anterior incision but Kumar found recurrence of symptoms in these patients thus stating that 12- 0 clock is not enough to relieve the obstruction. Blaivas et al [55] and Peng [56] et al used 5-o and 7 –o clock incisions and found no major complication as was feared by Turner Warwick. Xun-bo Jin etal modified the incions in female patients with PBNO. They gave 4 incisions at 6, 12, 3 and 9-0clock positions. Incisions were deepened at 3 and 9 –o clock and kept superficial at 6 and 12 positions. Total of 30 patients were studied. No un-toward complication occurred except in 1 patient who had mild stress incontinence which improved after 1 month of pelvic exercises. Holium lasers and neodymium yttrium aluminum garnet lasers has been used to do bladder neck incisions to reduce bleeding, catheterization time.

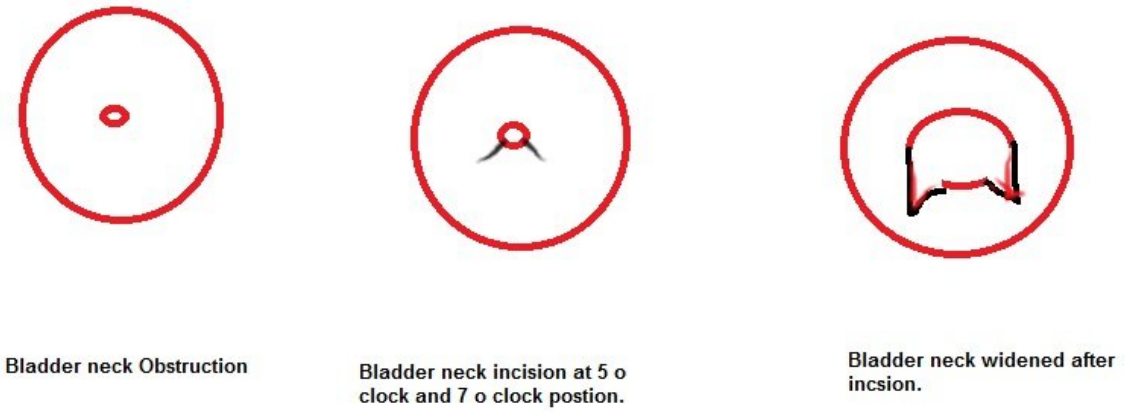


Figure 6 : Bladder neck Incision

Patients who are young and do not want bladder neck incision and have renal failure with upper tracts change are put on clean intermittent catheterization to preserve their upper tracts.

Alpha blockers

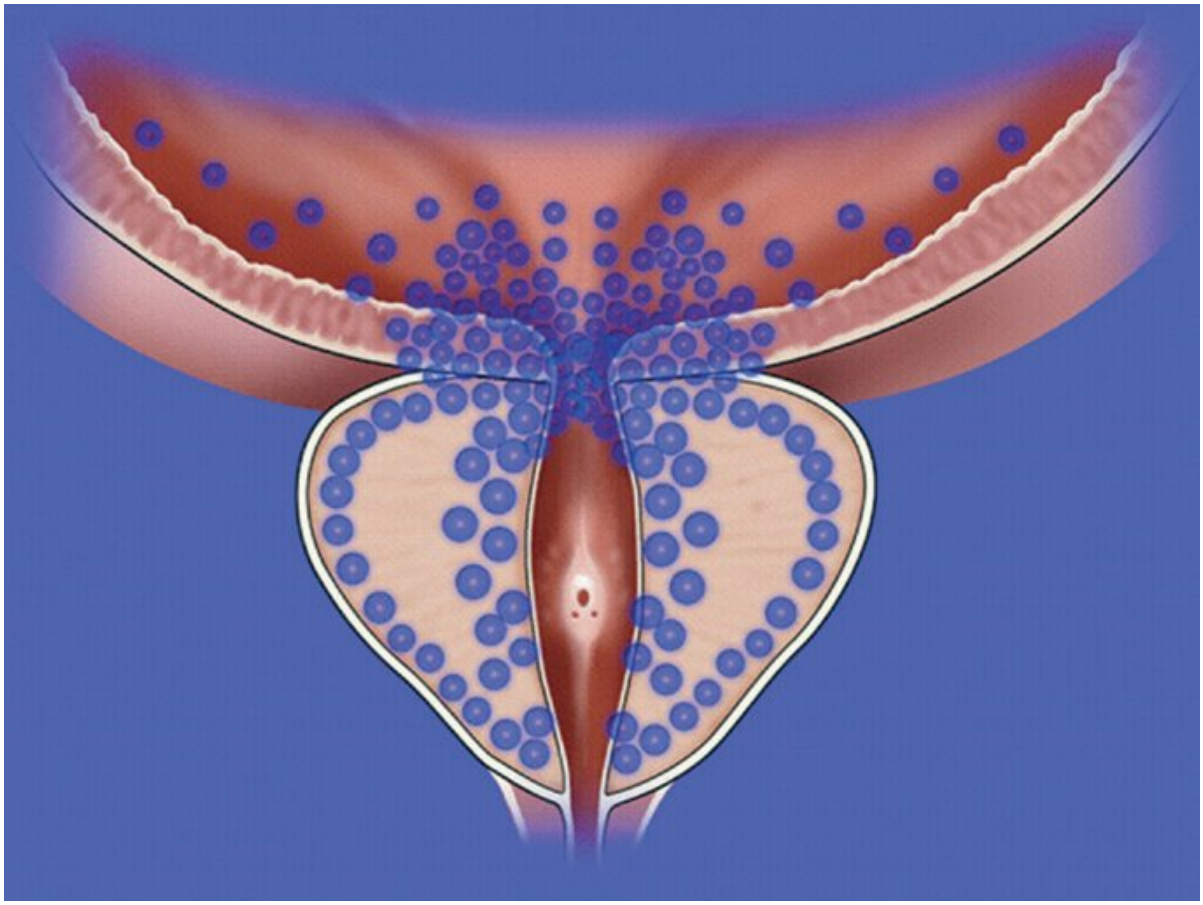


Figure 7: showing the distribution of alpha blockers in lower urinary tract

Bladder base and proximal urethral contains both alpha adrenergic receptors and beta receptors but predominantly alpha receptors largely by alpha 1A receptors. Internal sphincter is partially controlled by sympathetically stimulation of the adrenergic receptor at the bladder as proposed by Krane and Olsson. They hypothesized primary bladder neck obstruction could be because of resistance at the proximal urethra and alpha blockers could be useful in these patients.

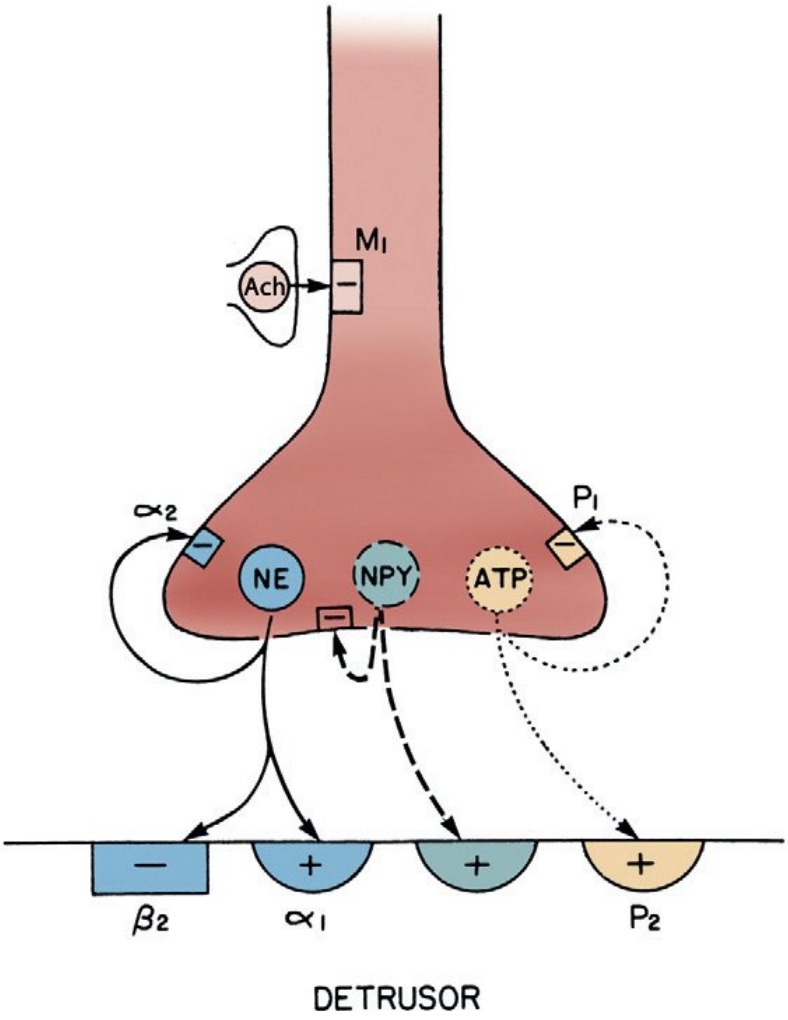


Figure 8: possible transmitters in an adrenergic terminal supplying the bladder or urethra. Norepinephrine (NE) release can activate α1-adrenergic receptors and produce contraction (+) or β receptors and cause relaxation (−) of the detrusor.

Feedback inhibition of NE release through α2 receptors can also occur. Neuropeptide Y (NPY) can produce smooth muscle contraction (+) or inhibit acetylcholine (ACh) release (not shown), or feedback can inhibit NE release. Adenosine triphosphate (ATP) can activate P2 receptors in the detrusor, which elicit contraction (+) or inhibit (−) further ATP release through P1 prejunctional receptors. ACh release from terminals in synaptic

contact with an adrenergic varicosity can inhibit firing of adrenergic axons by activation of M1 receptors.

The AUA recommends 1-adrenergic receptor blockers as safe and efficacious pharmacologic treatment options for patients suffering from BPH [51] . Alpha blockers block the adrenergic receptors, which are abundant in the smooth muscle of the prostate and bladder, produces a reduction in smooth muscle tone . Of the three alpha 1 subtypes (a1A a1B and a1D), a1A is seen as the primary regulator of smooth muscle tone in the bladder neck and prostate. In contrast, the a1B subtype regulates blood pressure via arterial smooth muscle relaxation, while the a1D subtype is associated with contraction of the bladder muscle as well as sacral spinal cord innervations muscle as well as sacral spinal cord innervations

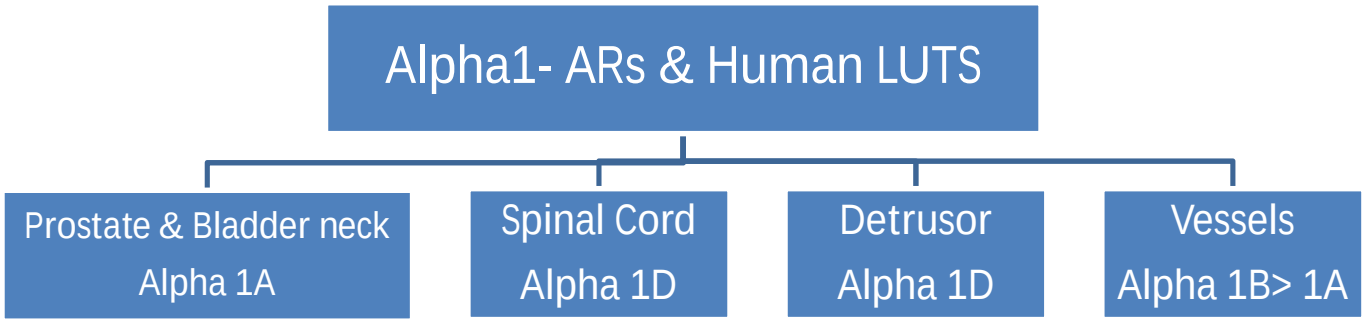


Figure 9: Distribution of Alpha 1 receptors Modified from Lepor [57]

Uro selectivity has been has been defined in different ways

Pharmacological uroselectivity [58] - It implies the drugs binding to alpha 1a and 1d receptors in prostate, bladder and bladder neck, urethra versus that regular vascular smooth muscles.

Clinical uroselectivity [58]- It has been defined as the desired clinical effects on urinary symptoms versus the unwanted effects of vascular complications like dizziness and orthostatic hypotension

Functional /physiological uroselectivity [58] – Defined as effect on urethral pressure compared to blood pressure

Tissue /drug portioning selectivity [59]- How the drug is distributed at the desired tissue to the non desired tissue.

In the search for more selective effects of alphablockers on the prostate, several alpha1-adrenoceptor subtypes have been cloned and identified in the prostate. However, the concept of uroselectivity is complex, and pharmacologic uroselectivity does not necessarily correspond with functional/ physiologic or clinical uroselectivity The contemporary alpha-blockers, such as alfuzosin, doxazosin, tamsulosin, and terazosin, appear to have a very similar therapeutic efficacy, producing a 20% to 30% increase in Qmax and a significant improvement in patients' symptoms. They have a rapid onset of action and are likely to be effective in many patients within days to weeks. The subtype selectivity and pharmacokinetics of the various alpha-blockers discriminate among different drugs. Doxazocin , Terazosin Alfuzosin are efficacious in hypertension and can cause vascular side effects whereas Tamsulosin does not reduce blood pressure and has less effect on postural hypotension. However clinical selectivity also

depends on dose, formulation, dose interval, etc, also on patient co- morbidity and interaction with other drugs.

The four most frequently prescribed alpha blockers – terazosin, doxazosin, alfuzosin and tamsulosin – vary in their subtype selectivity and are associated with differing side effect profiles

Because alpha blockers cause vasodilation, vascular- related adverse events take the form of dizziness, pre- syncope or syncope. These symptoms can be life threatening, particularly in an older patient population. Terazosin and doxazosin, originally developed as antihypertensive drugs, are non-subtype-selective alpha blockers, and both are associated with a larger number of vasodilatory side effects than either tamsulosin or alfuzosin (9–12). Both terazosin and doxazosin require titration in order to reduce the risk of vasodilatory side effects. While alfuzosin is also a non-sub- type-selective a1B, it is considered uroselective; it is associated with fewer vasodilatory adverse events and does not require titration. Tamsulosin differs from the other A1Bs in that it is selective for the a1A and a1D subtypes. Tamsulosin is associated with a low incidence of vasodilatory side effects and does not require titration[60]

Phenoxybenzamine was the first alpha blocker tried for BPH in 1976 [61] It was non selective alpha blockers. This was superior to placebo in relieving symptoms but it was limited in its use because of its side effect profiles mainly cardiovascular side effects.

Prazocin was the first specific alpha blocker which was used for bladder outlet obstruction. Small randomized placebo controlled trials showed its efficacy and better tolerability treatment of hypertension than phenoxabenzamine. Its requires multiple daily dosing, and causes hypotension, because they also act on the alpha-

adrenoceptors in the cardiovascular system, where they cause venodilation. This mechanism accounts for the side effects of alpha-blockers when used for patients with LUTS. With the recognition of the possibility of using these agents to block the sympathetic action in the prostate, attention has turned to the development and therapeutic use of selective alpha1-adrenoceptor antagonists with reduction of the unintended, usually mild, side effects, such as headache, dizziness, postural symptoms, and drowsiness.

FDA has approved 5 long acting alpha blockers for use for LUTS/BPH

(1)Terazosin- This was the first long acting selective alpha 1 blocker used for bladder outlet obstruction for benign prostatic hyperplasia. Lepor etal in his randomized study between placebo and Terazocin studied the efficacy of the drug. Terazocin in the dose of 2 mg 5 mg and 10 mg were given daily once a day. Dose titration is required to avoid first dose effect. Its adverse effects are tiredness, somnolence, retrograde ejaculation hypotension nasal congestion. Trial on Terazocin has shown asthenia in 7.4% of patients, dizziness in 9.1%, and postural hypotension in 3.9% [62]

(2) Doxazosin- This was second alpha blocker approved for use in BPH. The advantage was its longer half life. It causes decrease in blood pressure but only in hypertensive patients and not in normotensive patients. It also causes dizziness, fatigue,edema and dyspnea dyspnea. In clinical trials with Doxazocin used in BPH caused fatigue in 8%, dizziness in 15.6% and hypotension in 17.1%. This was significant as compared to placebo.[62]

(3) Alfuzosin- This is another alpha blocker approved by FDA for treatment of BPH. It has no selectivity for any receptor for alpha 1 subtype. It is long acting and slow releasing drug and does not require dose titration. It has comparable clinical efficacy as other alpha blockers but less chances of abnormal ejaculation.[63]

(4) Silodosin- It was approved for LUTS in 2008. It is more selective for alpha 1 a types receptors. It is 162 times more selective for alpha 1A than a1B and 55 times than alpha 1D[64]. It significantly improves the BPH related symptoms but have high incidence of abnormal ejaculation. It has been suggested that silodosin inhibits smooth muscle contraction in genital tissue and thus interferes with seminal emission. Study by Roehrborn [65] in 466 patients with Silodosin intake, found 28 % with abnormal ejaculation. In this subgroup with abnormal ejaculation 82 % patients reported 'orgasm with absence of seminal emission'. With the exception of abnormal ejaculation silodosin is the best tolerated alpha blockers.

(5) Tamsulosin- *Tamsulosin* hydrochloride is (-)-(R)-5-[2-[[2-(o-Ethoxyphenoxy) ethyl] amino]propyl]-2methoxybenzenesulfonamide, monohydrochloride

. Its structural formula is:

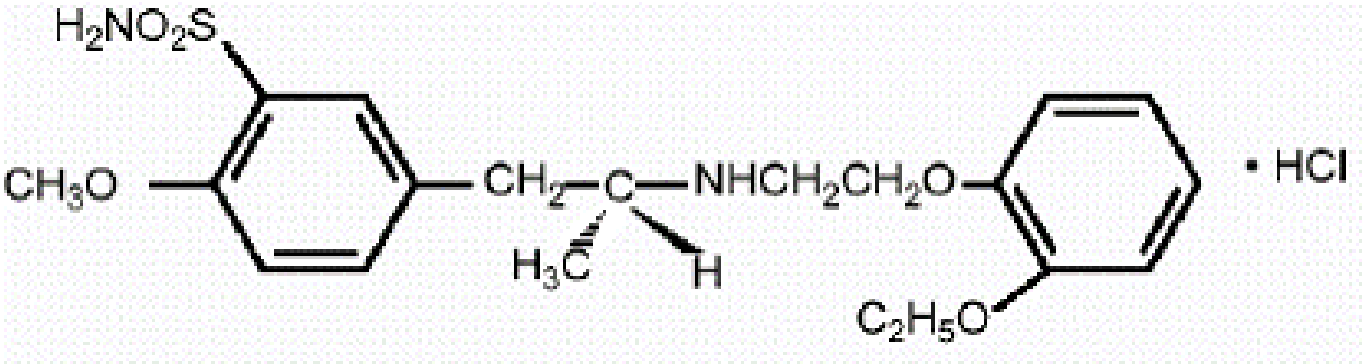


Figure 10: Structural formula of Tamsulosin

Tamsulosin is the most widely used alpha 1 antagonist for LUTs. It is also used in distal ureteric calculus, in alleviating stent related symptoms. It is selective alpha 1 a blocker with 10-20 times greater affinity to alpha 1A receptors vs alpha 1B[66]. It is the long acting drug and was first available in US in 1997.This results in smooth muscles relaxation of prostate and bladder resulting in improvement of symptoms Tamsulosin has low incidence of orthostatic hypotension as compared to other alpha 1 antagonist. It is because of selective alpha 1A antagonism. Also the continuous release of drug than immediate release may also be the cause of less side effects profile.

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Absorption- Tamsulosin is rapidly absorbed from the intestines and its bioavailability is almost complete. Absorption is slowed down if a meal has been eaten before taking the medicinal product. Uniformity of absorption can be assured by always taking tamsulosin after breakfast.

Tamsulosin shows linear **kinetics**. The steady state is reached by day five of multiple dosing, when C_{max} in patients is about two-thirds higher than that reached after a single dose. The maximum concentration is reached in 4-5 hours if drug taken in fasting condition and 6-7 hours if taken with food, resulting in minimal side effects. Tamsulosin is prepared in a modified release formulation

Distribution

It is a basic drug and 99 % protein mainly to alpha 1 acid glycoprotein, with a volume of distribution of -0.2 L/kg [67]. Acid glycoprotein is produced both in liver and prostate so there may be difference in plasma and prostate concentration of tamsulosin It has negligible first pass metabolism and it is metabolized by liver and metabolites excreted by kidney. systemic clearance of tamsulosin is -48 mL/min (2.8 L/h).But pharmacokinetic and safety profile does not change in renal or hepatic impaired patients and there is no need adjust the tamsulosin dose.[68] It doesn't have drug interaction with any anti hypertensive drugs being used. The only drug which has shown interaction with tamsulsin is cimetidine. It reduces its clearance by 26 % and increase it serum concentration. Cees etal in their study found that free Tamsulosin is present in much higher concentration in prostate and bladder than in plasma [59]

Biotransformation

Tamsulosin has a low first pass metabolic effect. Most tamsulosin is found unaltered in plasma. The substance is metabolised in the liver. In studies on rats, tamsulosin was found to cause only a slight induction of microsomal liver enzymes. The metabolites are not as effective and toxic as the active medicinal product itself.

Elimination

Tamsulosin and its metabolites are mainly excreted in the urine with about 9% of the dose being present in unchanged form. The elimination half-life of tamsulosin in patients is approximately 10 hours when taken after a meal and 13 hours in the steady state.

Adverse effects

Side effects include dizziness, rhinitis, insomnia and abnormal ejaculation although this has been demonstrated only in the elderly; the same result would also be expected in younger patients.

Abnormal ejaculation can be retrograde ejaculation, absent or decreased ejaculation and is dose dependent with incidence of 8.4 % and 18.1 % in 0.4 mg and 0.8 mg group respectively. This is the most common side effects of Tamsulosin. Alpha receptors are present in bladder neck, seminal vesicle and also in vas[69] Now this is because of wide opening of bladder neck and retrograde ejaculation or because of failure of emission is unknown as both can be caused by alpha receptor antagonists. Giuliano et al found that Tamsulosin had stronger effect on the bladder neck and seminal vesicle as compared to Alfuzosin and thus tamsulosin has more chances of abnormal ejaculation.[70] Kaplan et al studied the intermittent administration of Alfuzosin and found no difference in it efficacy[71] Similarly Gotkas et al studied the intermittent effect of Tamsulosin. They found both the daily dose and alternate dose of Tamsulosin had similar success effect but less abnormal ejaculation with alternate day dose.[72]

There are studies which has shown the decrease perfusion of bladder, prostate and bladder neck in patients with LUTS and cause of storage symptoms in them [73,74] Pingerra has reported increase in bladder neck and prostate perfusion after taking tamsulosin for 5 weeks and decrease in storage symptoms[73,74]

The safety and efficacy of Tamsulosin has been studied in various randomized trials done in Europe and United States[75.76] It is well established that tamsulosin is relatively selective for alpha1a and alpha1d-adrenoceptors over alpha1b-adrenoceptor

Alpha blockers are now being used in urology extensively in different conditions. It is being used in LUTS, CPPS, and chronic prostatitis, LUTS in female patients, Neurologic bladder dysfunction and to relieve stents related symptoms. 0.4 mg of Tamsulosin does not require dose titration 0.8 mg of Tamulosin has shown to be more effective but it requires dose titration and patients has to take 2 tablets of 0.4 mg as 0.8 mg is not available

Floppy Iris syndrome

It is described as iris billowing and progressive pupil constriction during cataract surgery. This causes complication during the cataract surgery especially posterior capsular rupture. The association of Tamsulosin and floppy iris syndrome was first reported by Chang and Campbell in 2005 [83] The exact pathophysiology is not well documented. Alpha 1 adrenergic are also found in the iris smooth muscle[77,78] and blockage of this muscle by Tamsulosin leads to atrophy of the muscle because of disuse impairing dilatation and change in iris behavior during cataract surgery [79,80] Just stopping the medicine before medicine does not guarantee to reduce the incidence of floppy iris syndrome. This can also occur with non selective alpha blockers but the incidence and severity with them are less as compared with tamsulosin. Chadha et al [81] found incidence of floppy iris syndrome with Tamsulosin to be 57 % and with other alpha blockers to be 2%. Similarly Oshika [82] in his prospective study found incidence of

IFIS in Tamsulosin and Naftopidil to be 43 % and 19 % respectively In a study by Palea etal on rabbit prostatic tissue found that alfuzosin act as Competitive antagonist and Tamsulosin acted as non competitive antagonist and so there are less chances of floppy iris syndrome with alfuzocin as compared to Tamsulosin.

AIM & OBJECTIVES

The Objective of this study was to assess the effect of the selective α1-blocker tamsulosin on urodynamic parameters and quality of life in male patients with Type I primary bladder neck obstruction.

The aim of this study was to assess the following-

- Primary end point was to see the fall in pdetQmax by 15 %
- Secondary outcome
    - Improved urine flow- Qmax increase by 2.5 mL/s
    - The IPSS reduction by 25 %
    - Improvement in quality of life
    - Decrease in post void residual urine volume (PVR).
    - Bladder outlet obstruction index (BOOI) to fall below 40

Materials and Methods

Selection of study subjects:

INCLUSION CRITERIA:

Young males 18-50 years of age diagnosed with Type I Primary bladder neck obstruction

EXCLUSION CRITERIA

1. Patients with primary bladder neck obstruction who have absolute indication of surgical intervention e.g. obstructive nephropathy, obstructive uropathy.
2. Neurological disease or diabetes mellitus.
3. Acute UTI.
4. History of drug intake likely to affect micturition.
5 Bladder stones
6 Patients who had previously undergone surgery to pelvic region
7 Previous allergy to a-adrenoceptor antagonists or sulpha drugs

Evaluation: Young male patients with bothersome LUTS had detailed clinical history and examination including focal neurological examination. International prostate symptom score (IPSS) was either self-administered or administered by the primary investigator to document the severity of symptoms and noted their bother including the quality of life. Focused neurological examination included observing gait, upper and

lower limb reflexes, tone, power and sensations, bilateral plantar reflexes, perianal sensations, anal sphincter tone, bulbocavernous and anal reflex and voluntary anal contraction. Urine routine and microscopy, serum creatinine & urine cultures were done. All patients underwent uroflometry. A representative flow with a minimum voided volume of 150ml was recorded. Imaging of kidney ureter, bladder was done with ultrasonography. Transrectal ultrasound was done to estimate the prostatic volume. Voiding cystourethrogram or cystoscopy was done to rule out urethral stricture. Patients satisfying inclusion and exclusion criteria underwent video-urodynamics. Patients with high pressure and poor flow with bladder outflow index more than 40 and poorly opening bladder neck were diagnosed as Primary bladder neck obstruction type I. These patients were started on Tab Tamsulosin 0.4 mg to be taken at bed time and followed after 3 months. On follow up patients repeated uroflowmetry, IPSS and urodynamic study. Data were collected and analyzed.

Interpretation of the videourodynamic study:

Videourodynamics was conducted in standing position. A six Fr infant feeding tube was used as vesical pressure measurement line; 8Fr infant feeding tube was used for bladder filling. Abdominal pressures were recorded with rectal balloon. Three surface electrodes were used for electromyography (EMG). Two electrodes were placed in perianal region at two and eight 0' clock position and one electrode on anterior abdominal wall as a neutral lead. Filling catheter was removed after completion of filling phase.

Zero pressure and reference height definitions were in accordance with ICS document on good urodynamic practice [29]

Reference height was defined as upper border of symphysis pubis. All transducers were placed at the level of upper border of symphysis pubis, so that all urodynamic pressure have same hydrostatic component.

Fluoroscopic examination was done in filling and voiding phase. During storage phase bladder sensation, detrusor activity, bladder compliance, bladder capacity and presence of leak or reflux were documented. During voiding phase detrusor pressure, urine flow, bladder neck opening and striated sphincter activity were documented.

Following terminology and their definition as per ICS guidelines were used in the study[48]

Bladder sensations.

1. First sensation of bladder filling is the feeling patient has during filling phase when he or she first becomes aware of bladder filling.
2. First desire to void is the feeling patient had during filling phase, that would lead patient to pass urine at next convenient moment.
3. Strong desire to void is defined as persistent desire to void without the fear of leakage.
4. Increased bladder sensation, was defined, during filling phase, as an early first sensation of bladder filling (or an early desire to void) and/or early strong desire to void, which occurs at low bladder volume and which persists.
5. Reduced bladder sensation was defined as decreased sensation during bladder filling.
6. Absent bladder sensation denoted that there were no sensations during bladder filling phase.

7. Non-specific bladder sensations were the sensations like abdominal fullness which made subject aware of bladder filling during the filling phase.
8. Bladder pain during filling phase was recorded as non-specific bladder sensation.
9. Urgency denotes sudden compelling desire to void.

Detrusor function during filling cystometry is defined as

1. Normal detrusor function which allowed bladder filling with little or no change in pressure.

a. Detrusor overactivity: Involuntary detrusor contractions which could be either provoked or spontaneous.

b. Patterns of detrusor overactivity:

i. Phasic detrusor overactivity: May or may not lead to urinary incontinence. They may not always be accompanied with bladder sensations or may accompany with first sensation of bladder filling or normal desire to void.

ii. Terminal detrusor overactivity results in incontinence and occurs at the cystometric capacity This is typically associated with reduced bladder sensation e.g. in elderly stroke patients.

2. Detrusor overactivity incontinence was defined as incontinence due to detrusor overactivity.

Bladder compliance was also defined and calculated as follows:

1. Bladder compliance is change in bladder volume with respect to change in detrusor pressure. It is calculated by dividing change in bladder volume by change in detrusor pressure and is expressed as ml/cm of water.

Bladder compliance less than 12.5 ml/ cm of water is taken as poor compliance

Bladder contractility index (BCI) is calculated by multiplying maximum flow rate by five and adding it to detrusor pressure at maximum flow rate:

BCI = 5x Qmax+Pdet@Qmax

a. BCI of less than 100 poor contractility,
b. 100-150 normal contractility and
c. >150- good contractility.

Flow rates were defined with use of following terminology:

1. Flow rate: volume of urine expelled via urethra per unit time. It is expressed as ml/sec.
2. Volume voided includes total volume expelled via urethra.
3. Maximum flow rate (Qmax) is maximum peak flow rate.
4. Time to maximum flow is time elapsed from onset of flow to maximum flow.
5. Opening time was the time between the onset of detrusor contraction and start of flow. Delay in opening time of more than 10 sec is considered significant delay in opening of bladder neck. Flow measurement delay of 1-2 sec was taken into account while measuring opening time. Maximum pressure is maximum value of measured pressure.
6. Pressure at maximum flow (PdetQmax) is minimum pressure at maximum measured flow rate.
7. Closing pressure is pressure measured at the end of measured flow.
8. Flow delay is time delay between bladder pressure and corresponding change in flow rate.

Detrusor function during voiding:

1. Normal detrusor function: when normal voiding is achieved by a voluntary initiated continuous detrusor contraction that leads to complete bladder emptying within a normal time span, in absence of obstruction. For a given detrusor contraction degree of rise in pressure depends on degree of bladder outlet obstruction.
2. Abnormal detrusor activity

a. Detrusor underactivity: was defined as a contraction of reduced strength and/ or duration, resulting in prolonged bladder emptying and / or failure to achieve bladder emptying bladder emptying with in a normal time span. Bladder contractility index less than 100 was used to define detrusor underactivity in this study.
b. Acontractile detrusor was defined as one which could not be demonstrated to contract during urodynamic study.

3. Post void residue was defined as volume of urine left in bladder at the end of micturition. In case there was minimal or no post void residue on repeated free flows then residue on urodynamic study was considered as artifact due to circumstances of study.

Urethral function during voiding was defined by following terminologies

1. Normal urethral function was defined as urethra that opens and is continuously relaxed to allow bladder to be emptied at normal pressure.
2. Abnormal urethral function was due to either obstruction due to urethral overactivity or fixed anatomical obstruction due to stricture or benign prostatic hyperplasia.

a. Bladder outlet obstruction was characterised by increased detrusor pressure and reduced urine flow. Bladder outlet obstruction Index (BOOI) was calculated by

subtracting two time maximum flow rate from the minimum detrusor pressure at maximum flow rate.

BOOI= Pdet@Qmax-2xQmax .

BOOI < 20 was taken as normal,

BOOI = 20-40 was taken as equivocal for obstruction

BOOI = 40 was taken as suggestive of obstruction (high detrusor pressure and low flow rate)

Outcomes

Primary outcome [84]

- Decrease in pdetQmax by 15 % from baseline -It is the minimum pressure recorded pressure recorded at the time of maximum flow rate during the urodynamic study. This pressure will be noted during the video-urodynamic study being done for diagnosis for PBNO and were compared with repeat urodynamic study after 3 months.

Secondary outcome

- Improved urine flow- Qmax increase by 2.5 mL/s – Maximum flow rate is the maximum measured value of the flow rate during micturition[8]
- The IPSS reduction by 25 %- [8]
- Post void residual urine volume (PVR) - It is the amount of fluid remaining in the bladder immediately after the completion of micturition.

- Bladder outlet obstruction index (BOOI) - It was calculated as follows, PdetQmax – 2Qmax. Men were considered obstructed if BOOI is greater than 40; unobstructed if BOOI is less than 20, and equivocal if BOOI is 20 to 40

Sample size[8]

It was calculated based on study by Yang Wang.The mean (sd) pdetQmax was 71.1 cm of H2O at the base line, while this was 60cm of H2O at the post intervention. Keeping alpha and beta errors at 5% and 20% respectively the sample size needed using two sided test was 28 patients.

Single Mean - Paired t-test	
Pre-test mean	71
Post-test mean	60
Standard deviation in Pre-test	20
Standard deviation in Post-test	20
Effect size	0.55
Power (%) %	80
Alpha Error	0.05
1 or 2 sided	2
Required sample size	28

Statistical analysis

Statistical package for social science (SPSS) version 16 was used for statistical analysis. Median of all the parameters with inter quartile range was studied. To show that there is a statistical significant difference between the pre and post-test values, the Wilcoxan matched pair signed rank test is used P value of ≤ 0.05 was taken as significant.

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RESULTS

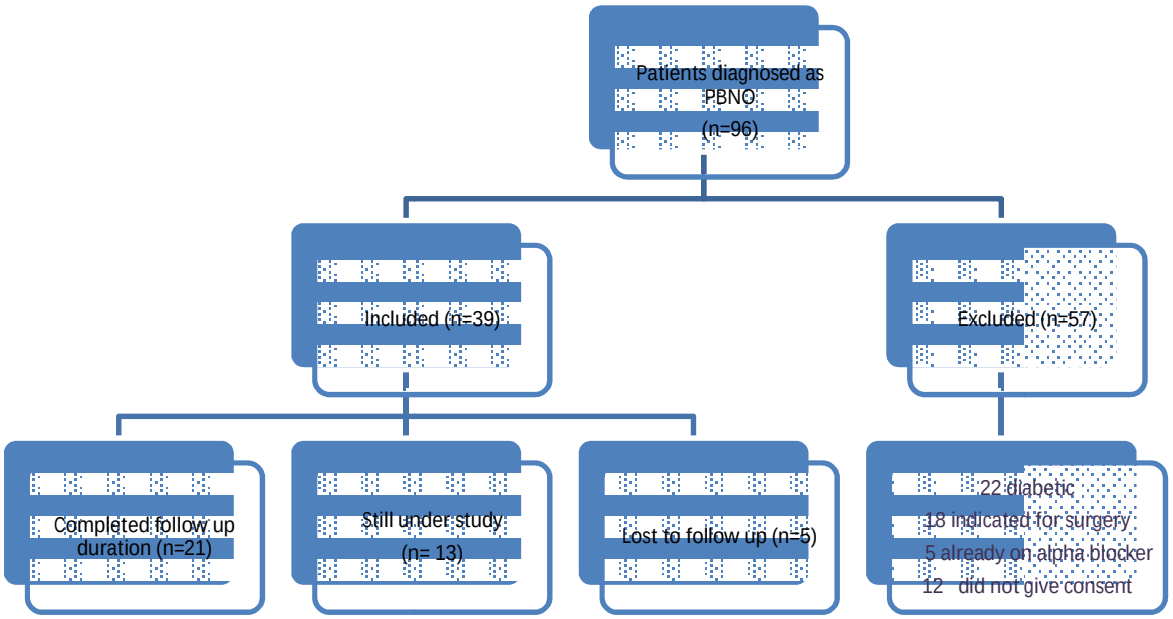

Figure 11: Study flow of Primary bladder neck Obstruction

During the period of the study total of 96 patients were diagnosed as primary bladder neck obstruction. In these 96 patients, 22 patients were diabetic, 5 patients were already on alpha blockers, 18 had indication for operation and 12 did not give consent. 39 patients fulfilled the inclusion criteria. 21 had completed the study and 13 are yet to come for follow up. 5 patients were lost to follow up. Out of these 5, one patient experienced severe giddiness and stopped the medicine.

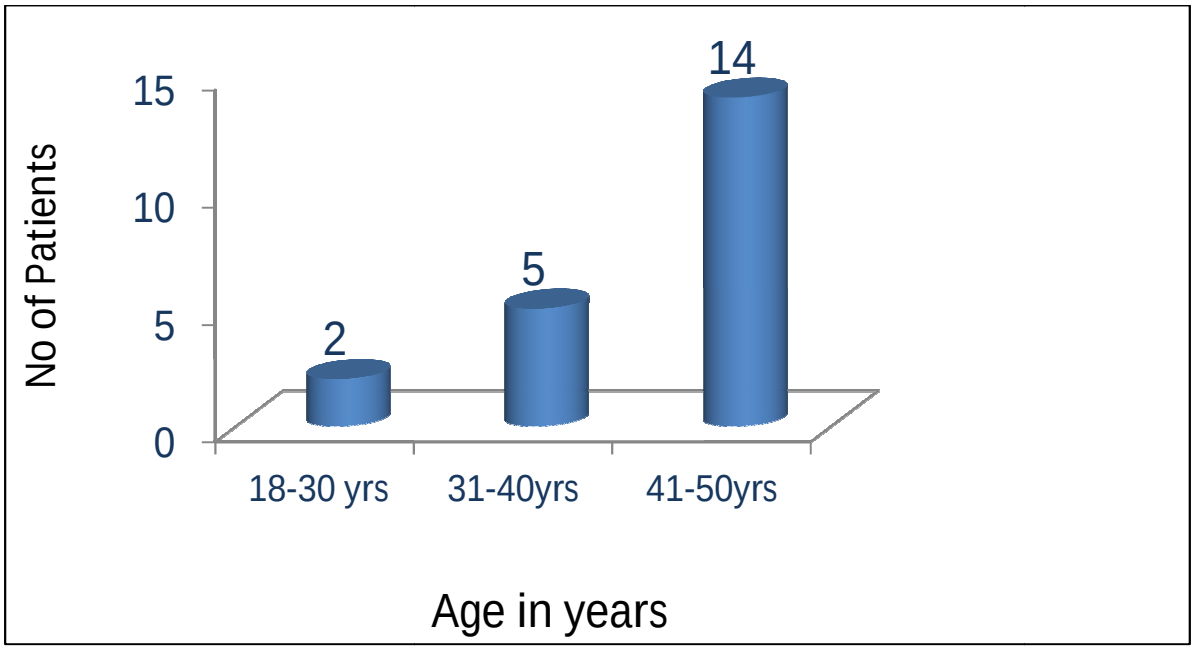

Figure 12: Distribution of study population in various age groups.

The study group comprised of 21 patients with mean age of 41 years. 14 patients were in age group of 41-50 years. Average duration of the symptoms was 50 months before they come for evaluation to the hospital. All the patients included in the study had normal serum creatinine and normal upper tracts on imaging. The mean transrectal prostatic volume was 13 ml. Urethral stricture was ruled out in all the patients by either cystoscopy or retrograde urethrogram.

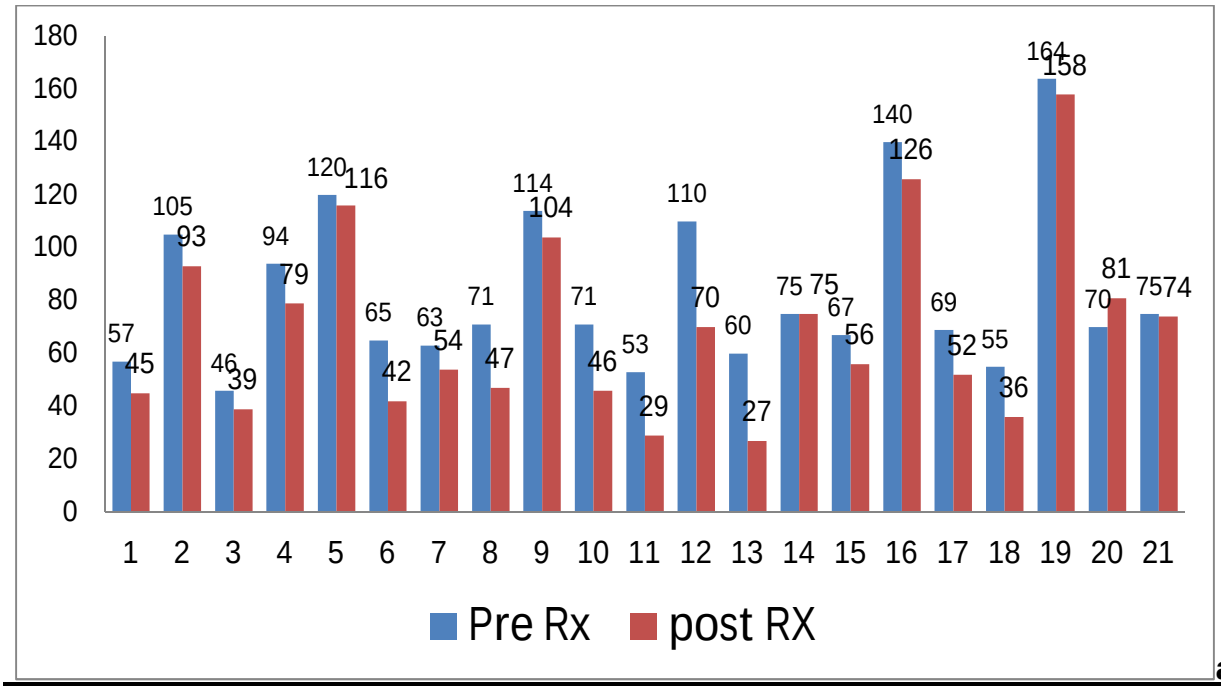

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Figure 13: pdetQmax before and after treatment

pdetQmax is the pressure at the maximum flow on urodynamic study. All these patients had high detrusor pressure with poor opening of the bladder neck on fluoroscopy and thus diagnosed as Type I PBNO. Median pdetQmax before treatment was 71cm H2O with inter-Quartile range (61.5 to 107.5). The median pdetQmax after treatment with Tab Tamsulosin was 56cm H2O with inter-Quartile range (43.5 to 87). As compared to the median of pdetQmax before treatment, there is decrease in median pdetQmax of 15 after the treatment and is stastically significant with p-value of 0.000.Two patients had detrusor activities on urodynamic studies before the treatment. These over activities resolved with alpha blockers and were not seen in follow up urodynamic study.

Primary Outcome

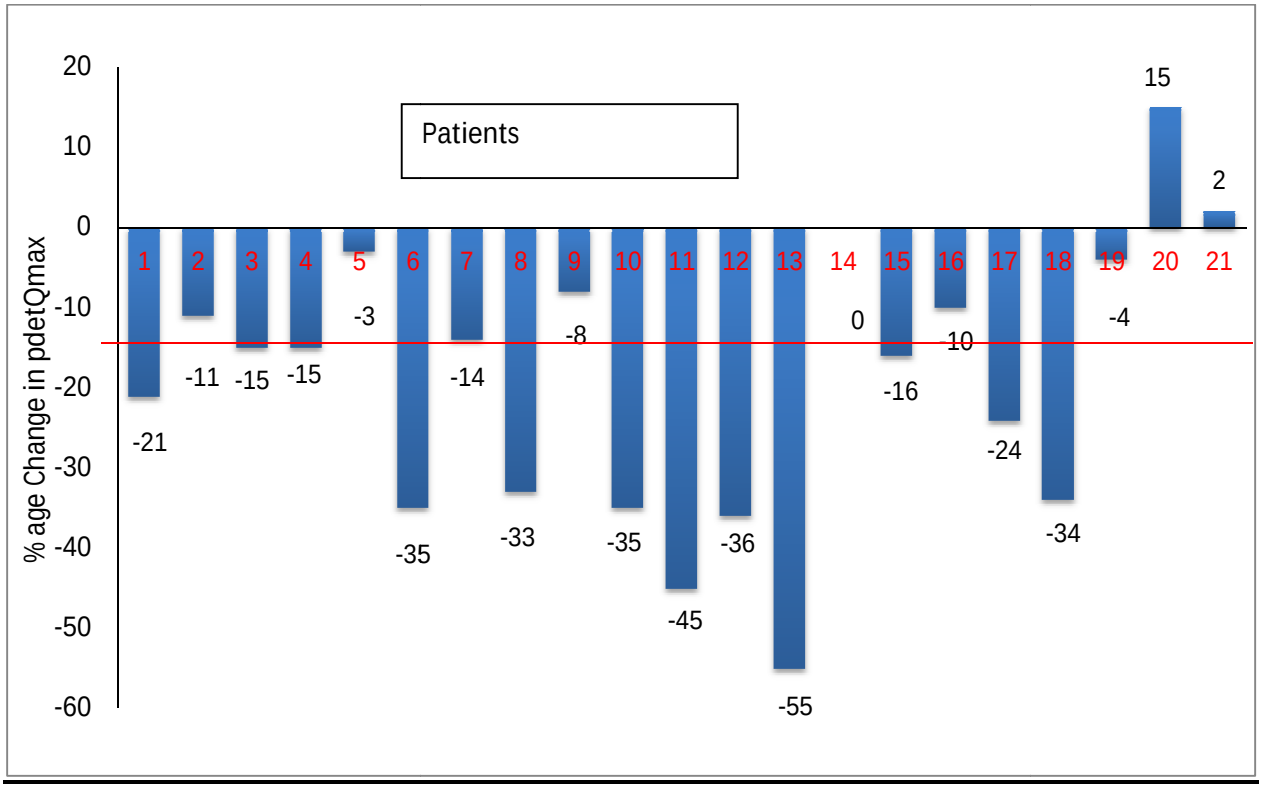

Figure14: percentage change in pdetQmax after treatment

85 % of the patient had at least some improvement in pdetQmax after the treatment. There were 2 patients whose detrusor pressure increased after the treatment there were 12 (57%) patients who had fall in detrusor pressure by more than 15% and achieved the primary outcome.

Secondary Outcome

1)Change in Bladder outlet obstruction Index

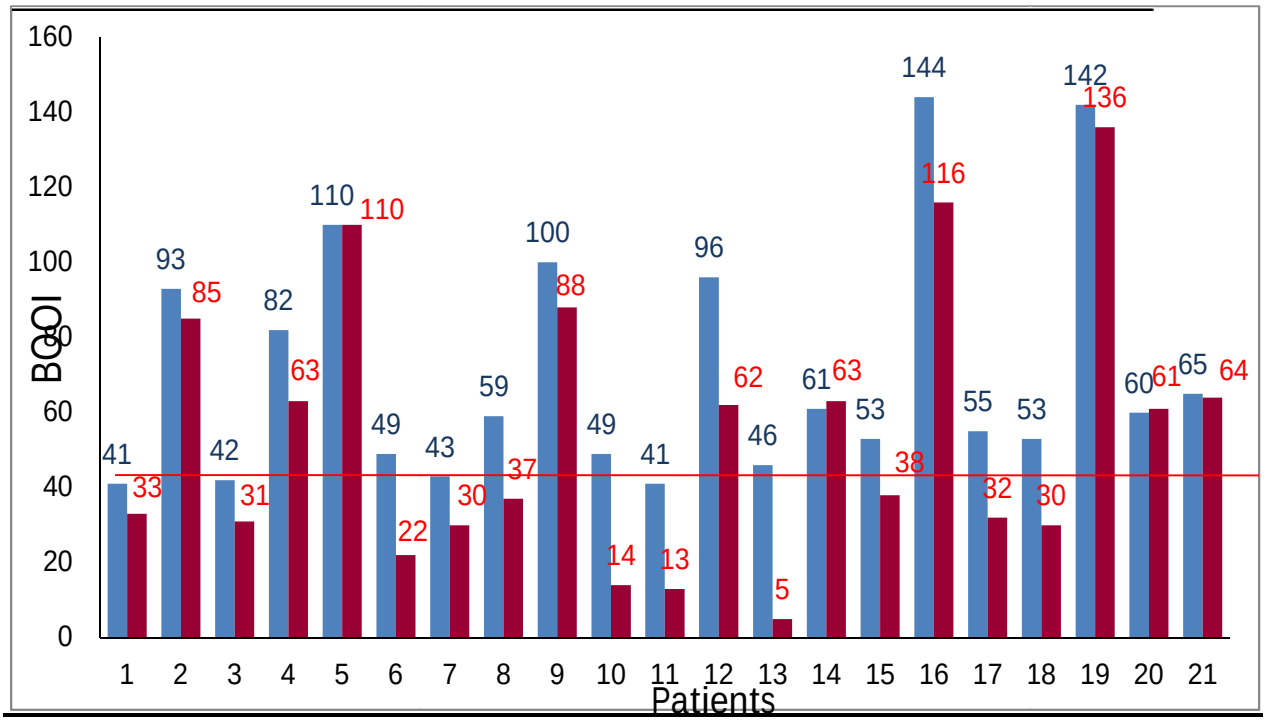

Figure 15: Bladder outlet obstruction index before and after treatment

Bladder outlet obstruction is calculated by pdetQmax-2Qmax. More than 40 is considered as obstructed where as less than is 20 is unobstructed and between 20-40 is equivocal. Median BOOI before treatment was 59.00 with the inter quartile range (47.50-94.50). Median BOOI after treatment was 38.00 with inter quartile range (30-74.50). Most of the patient had improvement in BOOI after the treatment. This was also statistically significant with P=0.000

Only 14 % patient actually becomes unobstructed with the treatment. When we compare it with BNI, it is quite less.

14 patients had BOOI in range of 40-60 before treatment. After treatment 3 patients achieved unobstructed BOOI i.e. less 20. 8 patients had BOOI in equivocal range 20-40 after treatment in this group. Only 3 patients remained obstructed so 78.5 % patients with BOOI in range of 40-60 achieved at least equivocal range. Rest of the patients (7) had BOOI above 60 before treatment and all of them remained obstructed after the treatment.

Table 1: Distribution of urodynamic parameters before and after treatment

	Before Rx (Median) N=21	**After Rx(Median) N=21**	**P value**
pdetQmax	71(61.50-107.50)	56(43.50-94.50)	0.000
BOOI	59(47.50-94.50)	38(30-74.5)	0.000

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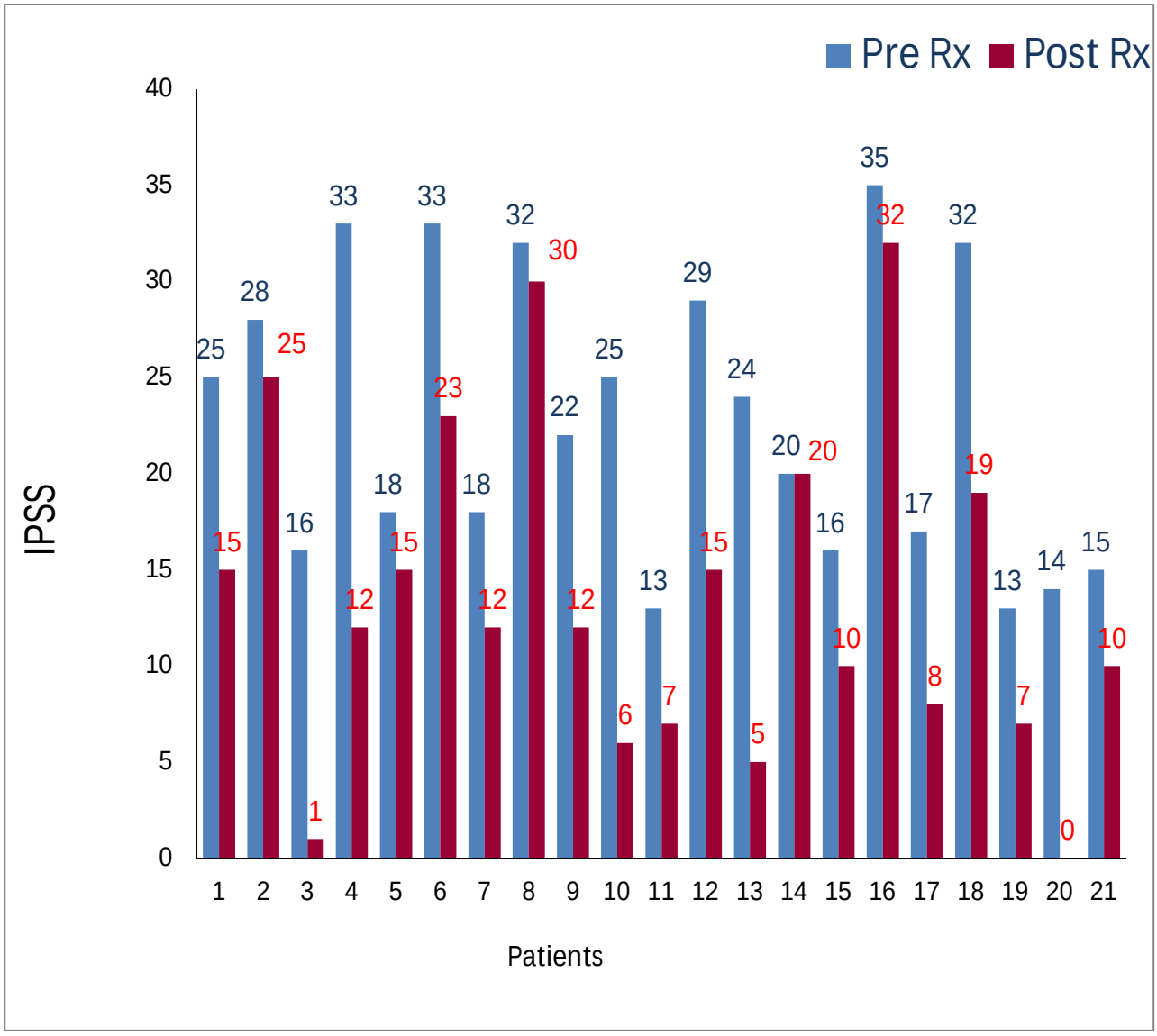

Figure16: IPSS before and after treatment with Tab Tamsulosin

Most of the patients had the subjective improvement in their symptoms after 3 months of oral tab Tamsulosin. The median IPSS before treatment was 22 with the inter quartile

range (16-30.5).The median IPSS after treatment was 12 with inter quartile range of (7-19.5). It was statistically significant with P=0.000

2) Change in IPSS

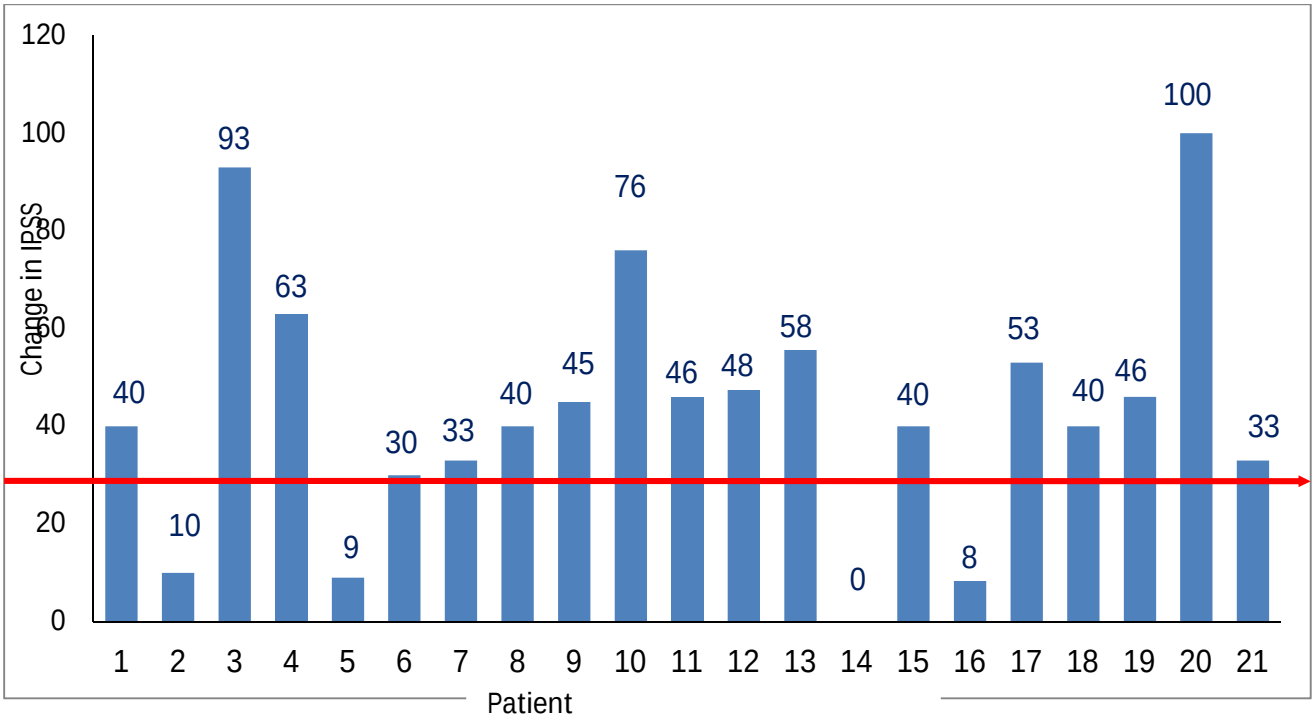

Figure 17: percentage change in IPSS after the treatment

Almost all the patients had symptomatic improvement after the treatment. Maximum percentage improvement was 100% and minimum 0%. Median change was 54 %. 17 patients (80%) out of 21 patients showed more than 25 % improvement in the symptoms score which was secondary outcome of this study.

3) Improvement in Quality of life Index

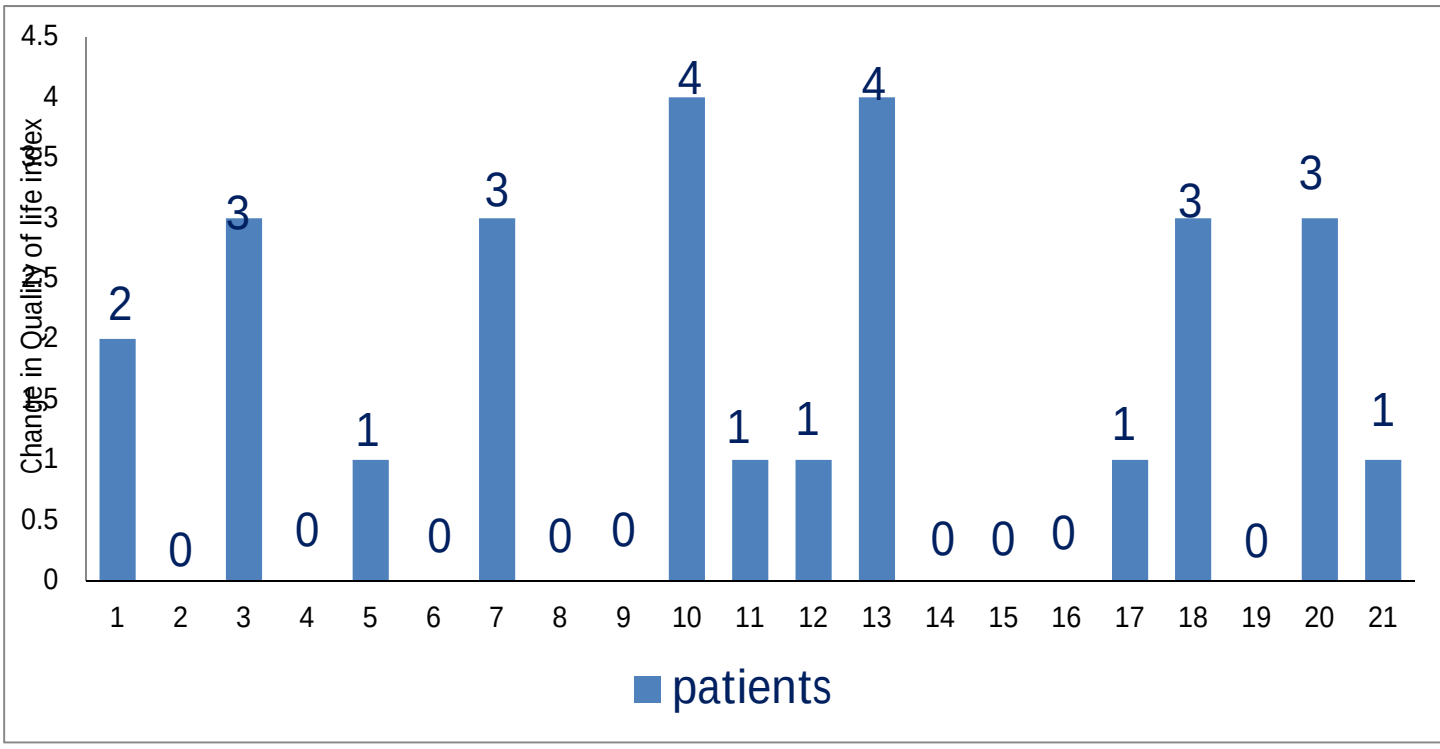

Figure 18: Change in Quality of life after treatment with tab tamsulosin for 3 months

12 patients (57 %) also showed improvement in quality of life after the treatment. The median score before treatment was 5 with inter quartile range (4- 5.5). The median score after treatment was 4 with range (2-5) with P=0.002 and was statistically significant.

Table 2: Distribution of IPSS scores before and after treatment (Median with inter-quartile range)

	Before Rx N=21	**After Rx N=21**	**P value**
IPSS Score	22(16-30.5)	12(7-19.50)	0.000
Voiding symptoms	15(10-19)	8(4-11)	0.000
Storage symptoms	7(5-12.50)	4(2-7.50)	0.000
Quality of life	5(4-5.50)	4(2-5)	0.002

4) Improvement in peak urinary flow rate

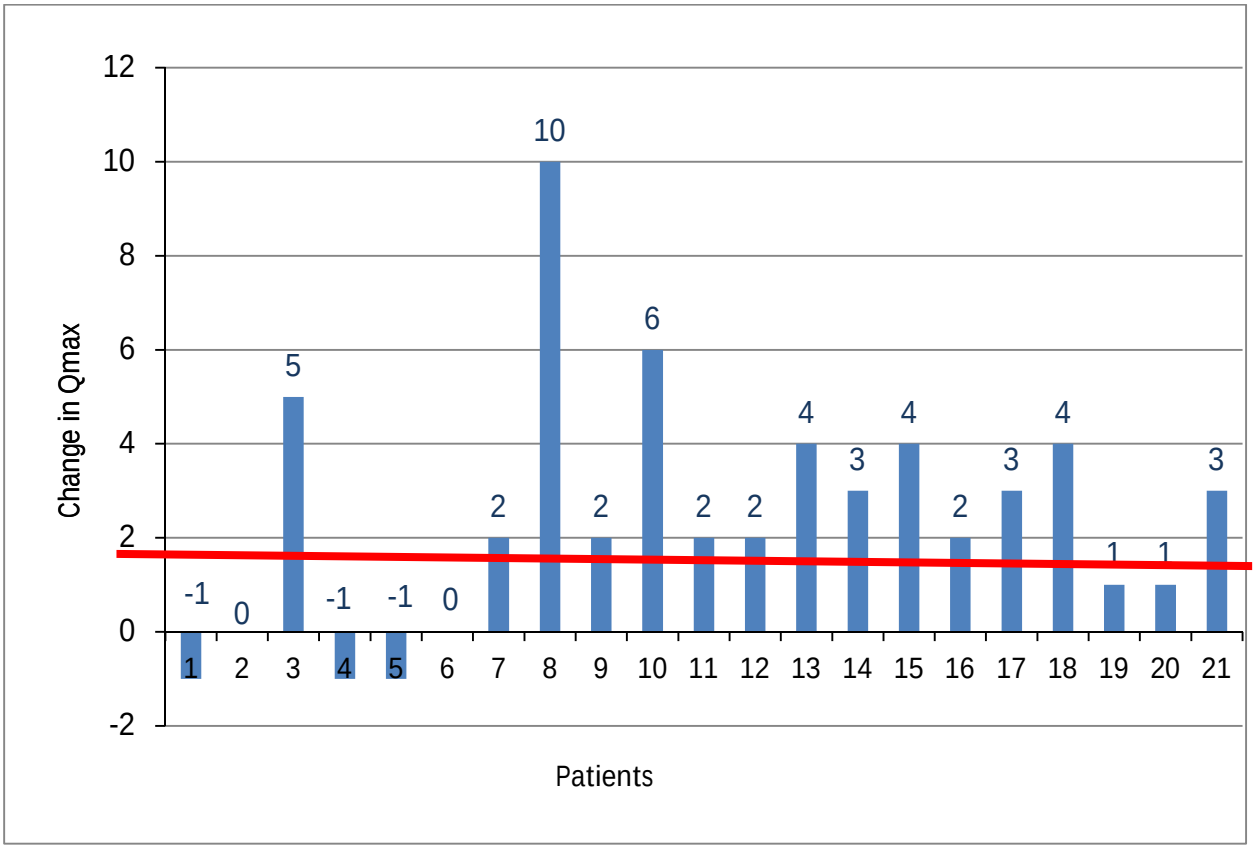

Figure19: Change in Qmax after the treatment with Tab Tamsulosin for 3 months

All the patients had improvement in the free flow except 5 patients who had no improvement or decrease in their flow. 14 patients had increase in their flow by more than equal to 2 ml/s but only 9 patients (42.85 %) achieved the secondary outcome. The median of maximum urine flow before the treatment was 8 ml/s with Inter-Quartile range (5.5ml/s to 10). The median of maximum urine flow after the treatment is 10 ml/s with Inter-Quartile range (8 to 12 ml/s). So there was median increase in the flow of 2ml/s after the treatment and this was statistically significant (p=0.05)

5) Change in Post Void residue urine

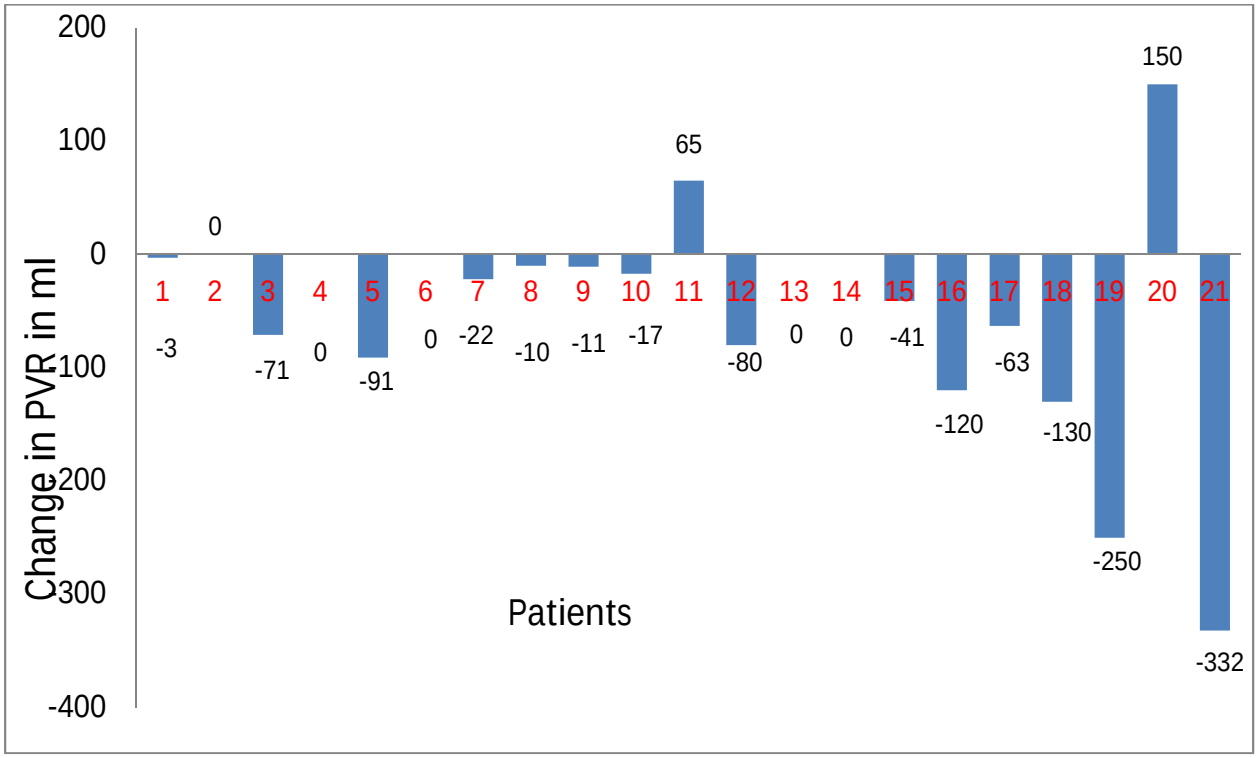

Figure 20: Improvement in post void residual volume after the treatment

Median post void residual volume before treatment was 82ml with the inter quartile range (40.50ml- 232 ml). Median post void residual urine volume after treatment was 50 ml with range of (33ml- 134 ml). This was statistically significant (p= 0.012)

There were in fact 2 patients who had increase in post void residual volume after treatment.

Table 3: Distribution of maximum flow rate during uroflow and post void residual volume

	Before Rx N=21	**After Rx N=21**	**P value**
Qmax (ml/s)	8(5.5-10)	10(8-12)	0.000
Post void residual volume	82(40.50-232)	50(33-134)	0.012

Tab Tamsulosin is well tolerated drug. Major problem with the medicine is the abnormal ejaculation. 10 patients (47.6%) complained of abnormal ejaculation. 3 patients had some giddiness for initial few days of the treatment but with time they got adjusted with the medicine. There was one patient who could not tolerate the drugs because of severe giddiness and discontinued the treatment and was excluded from analysis.

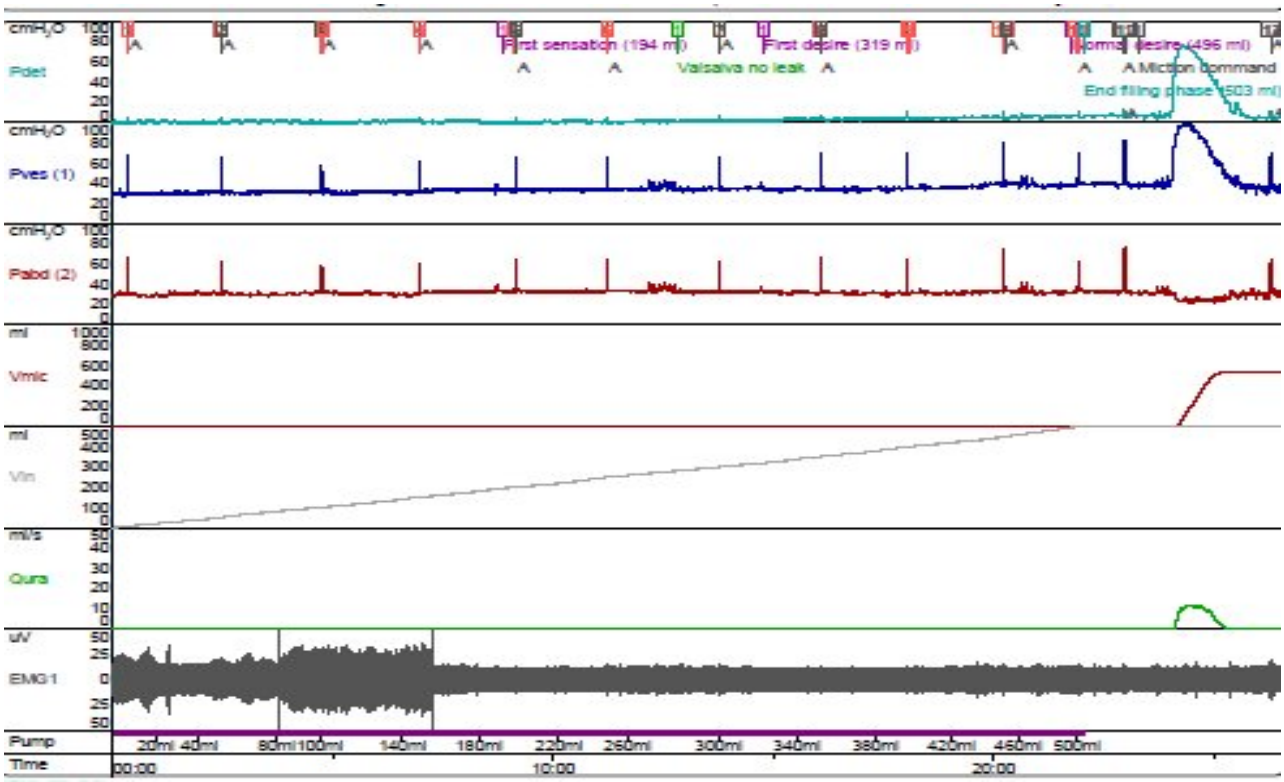

Figure 21: Urodynamic study before starting treatment

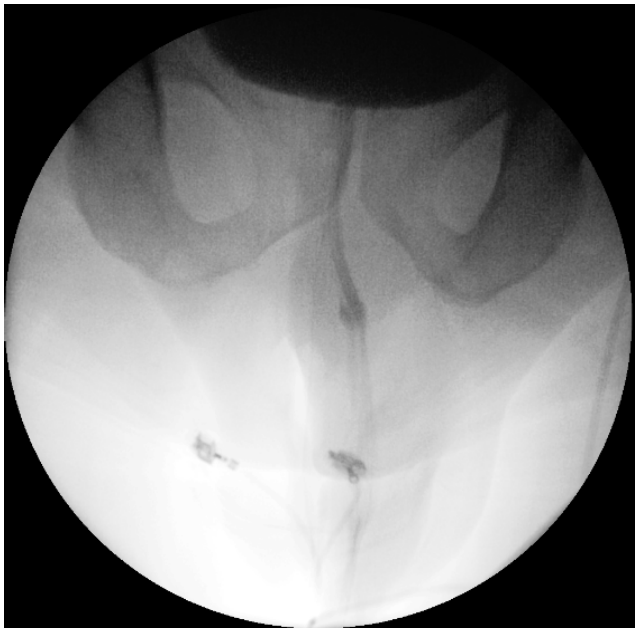

Figure 22: Fluoroscopy shows poor opening at the bladder neck

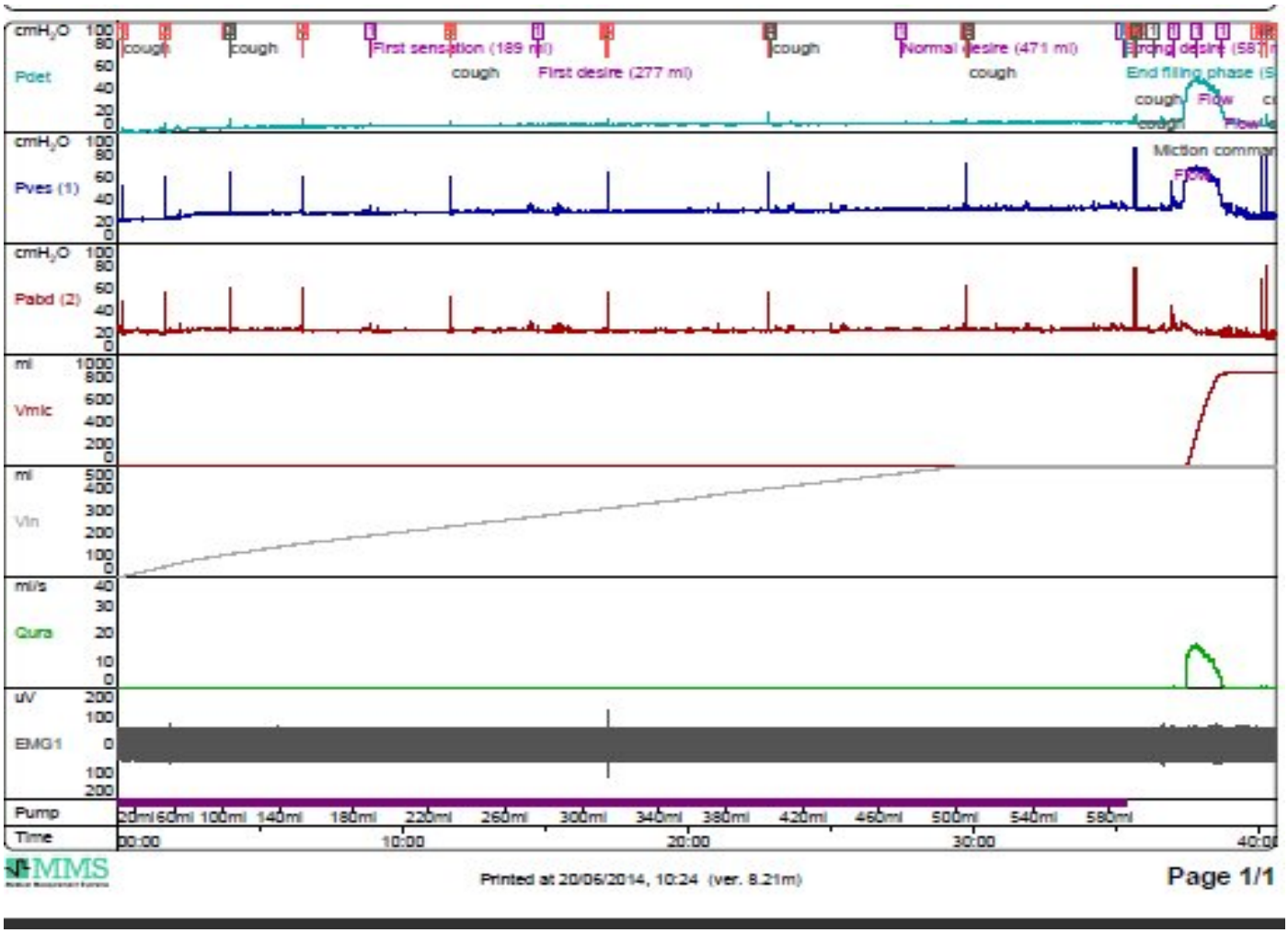

Figure 23: Same patient after 3 months on Tab Tamsulosin

Follow up

21 patients had completed follow up protocol. 5 of these patients had bladder neck incision and rests are continuing the medical treatment. 3 patients had no or minimal improvement with alpha blockers so opted for surgical intervention. 2 patients wanted surgery as personal l preference rather than continuing long term medication. During this follow there were 2 more patients who had subjective improvement with the medicine but improvement had not been demonstrated urodynamically. These 2 patients planned to continue with tab Tamsulosin .

Discussion

Table 4: Comparing different studies characteristics with the present study

S. No.	Study	Year	Type of Study	Number of patients	Drug Used	Age Mean (Years)	Duration of symptoms (months)
1.	Norlan and Blavias[4]	1986	prospective	9	Phenoxibenzamine	41	144
2.	Mishra et al[6]	1992	retrospective	15	Phenoxibenzamine	32	60-180
3.	Trockman et al [7]	1996	retrospective	7	Prazocin/Terazocin	40.8	72-84
4.	Nitti et al[3]	2002	prospective	17	Alpha blockers	35.5	-
5.	Yang et al[8]	2002	Prospective	28	Doxazocin	39.3	18.1
6.	Cisterno et al[85]	2006	retrospective	41	Alfuzocin/Tamsulosin	43	112-24
7.	Present study	2015	prospective	21	Tamsulosin	41	50

All the patients in our study were diagnosed as primary bladder neck obstruction based on Video-urodynamic study. Following the diagnosis all of them were started on Tamsulosin. There was no particular preference for this drug but this is the most

commonly used alpha blocker at present and to keep it standardized for all the patient we chose to give tab Tamsulosin. There are few studies who had tried to see the effect of alpha blockers on PBNO which includes both retrospective and prospective studies. Norlan etal and Mishra et al used non specific alpha blockers Phenoxibenzamine whereas others have used different selective alpha blockers. Mean duration of symptoms in our study was 50 months.

Table 5: Comparing IPSS with different studies

S no	Study	IPSS /AUA		QOL index	
		Pre Rx	Post Rx	Pre Rx	Post Rx
1	Trockman et al [7]	18.6±4.6 (AUA-6)	10.3± 4.9	□	□
2	Yang et al[8]	18.3 ± 4.6	11.6 ±5.2	4.1±1.1	2.6±1
3	Cisterno et al[85]	18.6 (AUA)	10.3	□	□
4	Present study	22.76±7.46	13.52±8.7	4.90±0.831	3.62±1,687

Our patients showed both subjective and objective improvement in their symptoms. 80% patients had more than 25% improvements in their IPSS. 28 % patients showed more than 50 % improvement in their IPSS. It showed median improvement of 54% and it was statistically significant. 57 % patients also admitted improvement in quality of life. Before starting the treatment the median QOL Index was 5 and after treatment it was 4. Trocman et al has demonstrated improvement in AUA score in 67% patients who continued alpha blockers. Similarly Nitti et al showed that 57% patients had

improvement in their AUA score with alpha blockers .Yang in his study found that 58 % patient had more than 50 % improvement in their IPSS and also had statistically significant improvement in quality of life index

Table 6: Comparing free flow and post void residual volume with other studies

S. No.	Study	Qmax		Post void residual	
		PreRx	Post Rx	Pre Rx	Post Rx
1	Norlan and Blavias [4]	9.1	□	159	□
2	Mishra et al [6]	7.89 ± 3.66	12 ± 2.76	104.5	□
3	Trockman et al [7]	11.0 ± 3.6	22.1 ± 13.	65 ± 62	45 ± 36
4	Yang et al [8]	11.8 ± 3.2	15.9 ± 3.9	80.2 ± 17.1	48.5 ± 10.3
5	Cisterno et al [85]	8.5	14	60.3	40
6	Present study	8.19 ± 3.4	10.52 ± 3.95	130.10±119	78.24 ± 64

All our patients had poor peak urinary flow rate with median of 8 ml/second with inter quartile range of 5.5 ml/s to 10 ml/s before the treatment. After 3 months of Tab tamsulosin median peak flow rate was 10 m/s. Most of the other studies have also shown significant improvement in the free and post void residual volume.

Table 7: Comparing pdetQmax with other studies

S. No.	Study	pdetQmax	
		Pre Rx	post Rx
1	Norlan and Blavias [4]	110	□
2	Mishra et al [6]	157	□
3	Trockman et al [7]	60	49 (1 Patient)
4	Yang et al [8]	70.1	-
5	Cisterno et al [85]	71.29	-
6	Present study	83± 31.29	69.00±34.5

Our patients also had objective improvement which was proved after the repeat urodynamic study. Almost 85 % patients had some improvement in their pdetQmax on follow up. 57 % patients had ≥ 15 % improvement in pdetQmax. Our mean peak voiding pressure was 83 cm of water before the treatment and mean of 69 cm of water after the treatment . Kaplan had reported mean peak voiding pressure in his study as 76.3 cm water and Webster as 60 cm water but Norlen and Blaivas and Mishra et al showed peak pressure with mean of 110cm water and 157 cm H2O respectively. Trockman did repeat urodynamic study only for 1 patient on follow up. Cisterno et al and Yang et

al had urodynamic study done for all the patients on follow up and they compared their result on Schafer nomogram.

Interesting results were seen with bladder outlet obstruction index. Median BOOI before treatment was 59 and after treatment 38 this was also statistically significant with P=0.000. Only 3 patients (14%) actually became unobstructed with the treatment.

14 patients had BOOI between 40-60. All the patients who became unobstructed belonged to this group. Another 8 patients became equivocal for obstruction. So 78.5 % with BOOI between 40-60 had actually become unobstructed or equivocal urodynamically. Rest of the 7 patients had BOOI more than 60. All these patients remain obstructed with alpha blockers. This is contrary to the study by Yamanishi T et al [86] who stated that high detrusor flow and low flow were the predictor for success of the medical treatment. They hypothesized that higher detrusor pressure and lower Qmax suggest greater degree of obstruction and preserved detrusor function. Patients who have lower pressure presents late to the urologist and delayed treatment may be the reason for poor response. Similarly Yang et al [8] and Cisterno et al[85] also showed improvement in patients who were in higher level in Schaffer nomogram. They included the patients with type 2 PBNO and they were in category 1 or 2 in Schaffer nomogram. Our study did not include type 2 PBNO as they are difficult to monitor objectively after the treatment. Further studies will be required to validate this finding that patients with BOOI between 40-60 have greater chances of improving with alpha blockers.

Table 8: Comparing success with other studies

S. No.	Study	Success	Criteria
1	Norlan and Blavias [4]	4.3 %	Subjective improvement (Not Defined)
2	Kaplan [5]	None	Subjective (Not Defined)
3	Mishra et al [6]	60%	Flow from 7.89 ml/s to 12 ml/s(Not defined)
4	Trockman et al [7]	67 %	Flow and AUA -6 scoring(Not Defined)
5	Nitti et al [3]	58%	Subjective (Not Defined)
6	Yang et al[8]	54.2%	IPSS –improvement by 50 %, Flow improvement >2.5 ml/s
7	Cisterno et al [85]	70.7%	Schafer nomogram
8	Present study	57% 52%	Fall in pdetQmax ≥15% IPSS improvement >25% BOOI after treatment ≤40

This study proved 57 % patients had fall in pdetQmax by 15 % and 52 % had bladder outlet index of ≤ 40 after the treatment. 54 % patients showed subjective improvement by more than 25 %. Norlan and Blavias study only 1 patient had subjective improvement in his symptoms which was not even quantified. Similarly Kaplan study showed no improvement in their subjects. There is no prospective study who had used urodynamic study on follow up. Yang et al [8] showed 54.2 % success in patients who took alpha

blockers based on improvement in IPSS and Qmax. There was one study in literature that had done urodynamic after treatment with alpha blockers and compared their results based on Schaffer graph. They showed 70 % success rate with alpha blockers.

Table 9: Comparing the adverse effect of the drug with other studies

S. No.	Study	Drug Used	Complication
1	Norlan and Blavias [4]	Phenoxibenzamine	Not reported
2	Mishra et al [6]	Phenoxibenzamine	2 patients- orthostatic hypotension
3	Trockman et al [7]	Prazocin/Terazocin	None
4	Nitti et al [3]	-	Not reported
5	Yang et al [8]	Doxazocin	none
6	Cisterno et al [85]	Alfuzocin/Tamsulosin	None
7	Present study	Tamsulosin	3 (14%) –mild giddiness 10(47.6%)-Abnormal ejaculation

The alpha blockers have immediate therapeutic response but it usually takes 4-6 weeks for maximum effect. Most of our patients tolerated the drug well as seen in other studies. 3 of our patients complained of some giddiness initially which settled subsequently. There was one patient who withdrew from the study because of severe giddiness which he could not tolerate. He was not included in our study. As opposed to

other studies for PBNO we found 47% patients who complained of abnormal ejaculation. If we compare other studies none of the studies have used Tamsulosin except Cisterno who used both Alfuzocin and Tamsulosin but the exact number of patients who used Tamsulosin is unknown. Most of the cases of abnormal ejaculation with tamsulosin have been reported on patient with benign prostatic enlargement which ranges from 8.4% to 18.2. It could be possible that in our case as the patients were comparatively younger age group and appeared to be more sexually active we found higher incidence of abnormal ejaculation. Initially it was thought that alpha blockers causes retrograde ejaculation. Recent studies have shown that adrenergic receptors are also present in the seminal vesicle and vas. There is the possibility of decrease in seminal emission along with widening of bladder which causes abnormal ejaculation with alpha adrenoreceptors.

Our study was not beyond limitations. The main limitation of our study was the compliance of the patients and their follow up. Most of our patients are out patients especially from West Bengal, Jharkhand and Bangladesh and they had to travel for 2000-3000km. So follow up of these patients was a real problem. Compliance was another issue. There were patients who could not come exactly after 3 months and some of them left the medicine after 3 months and they had to be restarted the medicine before we went for follow up evaluation. 5 patients lost to follow up and some are yet to report. We do not have any idea about those 5 patients except one who admitted that he left the drug because of severe giddiness associated with the medicine.

CONCLUSION

Primary bladder neck obstruction is a disease of young individual with unknown etiology. It is very frequently seen in outpatient department. Alpha blockers have been the first line of treatment for the same with bladder neck incision being the definitive surgical treatment. Mean age group of the patients in our study was 42 years. This study found both subjective and objective improvement in the symptoms with alpha blockers.

57 % patients had more than 15 % decreases in pdetQmax and achieved the primary outcome.

Secondary Outcome

- Bladder outlet obstruction index was decreased to below 40 in 52 %
- IPSS decreased by 25 % in 80 % patients
- Quality of life index improved in 57 % patients
- Peak urine flow increased by 2.5 ml/s in 42.85 % patients

Tamsulosin was quite safe but 47 % patients complaining of abnormal ejaculation .

Since this study was conducted in tertiary care centre with small group of patients, the precision of the outcome estimates may be limited.

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Performa for URODYNAMIC APPRAISAL OF SELECTIVE ALPHA 1A BLOCKER TAMSULOSIN ON PRIMARY BLADDER NECK OBSTRUCTION IN MEN

Name Age (18-45):

Phone No : Land line phone no:

Permanent address:

Occupation : Monthly income:

Married : Y/N Children

HISTORY:

Main symptoms:

Duration of symptoms

History suggestive of neurological involvement: (ED/ motor or sensory symptoms/ Cerebellar symptoms/ abnormal gait)

History of calculuria/Hematuria

History of urinary retention(Acute/acute on chronic/chronic)

On CIC or catheter:Y/N If yes indication for the same

History of recurrent UTI/Urinary tuberculosis/ urolithiasis

History of psychiatric symptoms/diagnosis/medications

IPSS Score Voiding IPSS Storage IPSS

Post micturation IPSS

Co morbidity - DM /Neurological /Hypertention

Examination

Height	Cm
Weight	Kg
Bladder palpable	Yes/No
Meatus	Normal/Stenosed
Prepuce	Normal/Circumcised/BXO Present/absent /
Testis and cords	Normal /abnormal
BCR	Absent /Present
Voluntary anal Contraction	present /absent
Anal tone	normal/lax
Prostate:	Clinically benign / malignant
Clinical size of prostate	Gm
Knee reflex	Normal /exaggerated/absent
Ankle reflex :	Normal/ exaggerated /absent
Plantars:	Extensors/flexors / equivocal
Bilateral lower limb Sensations	Normal/decreased / absent
perianal sensations	Normal/decreased / absent

:

INVESTIGATIONS

Urine microscopy	--RBC's , WBC's
Urine C/S	
S creatinine	mg%
Uroflow	--/--/--
shape of flow rate	bell shaped, box shaped, interrupted
X-Ray KUB	
<u>USG</u> <u>Prostate volume</u> <u>Bladder wall thickness</u>	
Cystoscopy:	

Bladder Diary

MVV	**ml**
Daytime frequency	
Night time frequency	
Total fluid intake	**ml**
24 hour urine output	**ml**
Nocturnal urine output	**ml**

CMG findings

Pretest PVR and flow rate:

<u>Filling phase:</u>

Sensations:	Normal, decreased, absent
Compliance	Normal /Decrease
DOA	present/absent
If present (DOA)	Spontaneous/precipitated
Started at filled bladder volume of:	ml
Amplitude of DOA	
Associated with leak	Y/N
Reflux	Y/N If present grade
Bladder wall	smooth/ trabeculated
Leak	Y/N If present ALPP/DLPP

Voiding phase:

Voiding:	Spontaneous /initiated by DOA
Coordinated detrusor contraction	Y/N
Max amplitude of detrusor contraction	
Qmax:	
Pdet @Qmax	
Sphincteric activity	absent/present/ equivocal
Flow corrected Q max	
Delay in starting of flow	
Bladder neck	
Reflux	present /absent
Post void residue	

Impression:

Intervention:

Follow up @ 3months

Flow

IPSS(T/V/S/PV)

Complications:

Urodynamics at 3 month

Pretest PVR and flow rate:

Filling phase:

Sensations:	Normal, decreased, absent
Compliance	Normal /Decrease

DOA	present/absent
If present (DOA)	Spontaneous/precipitated
Started at filled bladder volume of:	ml
Amplitude of DOA	
Associated with leak	Y/N
Leak	Y/N If present ALPP/DLPP

Voiding phase:

Voiding:	Spontaneous /initiated by DOA
Coordinated detrusor contraction	Y/N
Max amplitude of detrusor contraction	
Qmax:	
Pdet @Qmax	
Sphincteric activity	absent/present/ equivocal
Flow corrected Q max	
Delay in starting of flow	
Post void residue	

Impression:

Final result:

Class Homepage

This is your class homepage. To submit to an assignment click on the "Submit" button to the right of the assignment name. If the Submit button is grayed out, no submissions can be made to the assignment. If resubmissions are allowed the submit button will read "Resubmit" after you make your first submission to the assignment. To view the paper you have submitted, click the "View" button. Once the assignment's post date has passed, you will also be able to view the feedback left on your paper by clicking the "View" button.

Assignment Inbox: The Tamil Nadu Dr.M.G.R.Medical Uty 2014-15 Examinations

	Info	Dates	Similarity	
TNMGRMU EXAMINATIONS	ⓘ	Start 01-Sep-2014 11:27AM Due 15-Aug-2015 11:59PM Post 15-Aug-2015 12:00AM	17%	Resubmit View

ABBREVIATIONS

AUM – Ambulatory urodynamic study

CIC – Clean intermittent catheterization

EMG - Electomyography

IPSS – International prostate symptoms score

LUTS – Lower urinary tract symptoms

OPD – Outpatient department

PBNO – Primary bladder neck obstruction

PFS – Pressure flow study

PVR – Postvoid residue

Qmax – Maximum flow rate

UDS – Urodynamic study

UPP – Urethral pressure profile

VCUG – Voiding cystourethrogram

VUDS – Video urodynamic study

IFIS- Intra operative floppy iris Syndrome

BOO – Bladder outlet Obstruction

TUIP- Trans urethral incision of prostate

BOOI- Bladder outlet obstruction index

A-G- Abrams-Griffiths number